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BOARD OF EDUCATION—THE CITY OF NEW YORK  
BUREAU OF REFERENCE, RESEARCH AND STATISTICS

**Grade Standards**  
for the  
**New York**  
**Penmanship Scale**

1920

Publication No. 18





New York City, Bureau of Education,

# Grade Standards for the New York Penmanship Scale

Issued by the Bureau of Reference, Research and Statistics

EUGENE A. NIFENECKER, *Director*

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ANNING S. PRALL,  
*President, Board of Education*

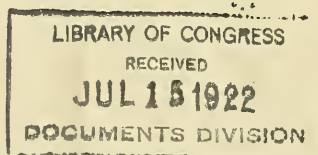
WILLIAM L. ETTINGER,  
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## INTRODUCTION

The present study represents one of a series of steps taken in New York City to establish definite goals of attainment in penmanship.

On May 7, 1914, Dr. William H. Maxwell, City Superintendent of Schools, appointed a committee of teachers of penmanship to advise the Board of Superintendents as to (1) a uniform type of letters to be taught in all the schools; and (2) to formulate instructions to teachers as to the teaching of muscular movement penmanship. Subsequently in February, 1915, the Board of Education, upon the recommendation of the Board of Superintendents, adopted a uniform style of letters to be taught in all the city schools and also authorized the teaching of the muscular movement method of writing which had been tried out in a number of schools for several years previous.

The next step taken was the construction of a scale from the product of this system of penmanship. This was undertaken at the request of Acting Superintendent of Schools Straubenmüller by Messrs. Lister and Myers, Instructors in the Brooklyn Training School for Teachers. The resulting scale was officially adopted by the Board of Education in February, 1918.

The setting up of grade norms for each of the elements measured by the scale was the aim of a study undertaken by the Bureau of Reference, Research and Statistics in June, 1919, and is the subject of this report.

The grade standards set up as a result of the study were recently approved by the Board of Superintendents for adoption as part of the course of study and syllabus in penmanship.

Inasmuch as the results of the study were reported upon in the December, 1920, number of the Journal of Educational Research, it was originally decided not to issue the report as a publication of the Bureau. Repeated requests for the report, coupled with the adoption of the standards recommended, have led to its publication at this time.

Acknowledgment is herewith made of the assistance rendered by Mr. Lister, Instructor of Penmanship in the Brooklyn Training School for Teachers, by Mr. Hugo Newman, Principal of the New York Training School for Teachers, and by Dr. Hamilton and Miss Scheuerman, Instructors in the latter named school. Without their untiring efforts in the training of the judges, who were training school students, and in the scoring of the papers the survey would have been impossible.

## I. THE NEW YORK PENMANSHIP SCALE

### 1. CHARACTERISTICS

The New York City Penmanship Scale possesses certain characteristics which distinguish it from the scales that preceded it. In the first place it is a scale constructed from the product of the system of penmanship it is intended to measure.

The second characteristic of the scale is the fact that it is analytic. In judging ability in penmanship there are so many things to be considered that a scale based on general merit only is of little assistance to the average teacher. The scale should help the teacher to look for the essentials in judging a given specimen of writing. Legibility, ease in writing or freedom of movement, good letter formation, uniformity of size, uniformity of slant, clear and uniform spacing, neatness and an easy, fluent appearance, all these make up the value of writing. \*"A scale by which each of these qualities must be estimated or judged individually would be too complicated to be practical. But it has seemed possible and practicable to group most of these qualities under three headings and thereby make a scale that will enable teachers to look for distinct qualities when grading specimens of penmanship. This should also enable the teacher to discover where the penmanship of her class is weak and to point the way to improvement; in other words, to analyze her product."

"With this idea in mind it was decided to select and arrange specimens under three distinct headings, Form, Movement and Spacing, thereby making what might be termed a triple scale.

"Under the caption FORM, it was decided to consider accuracy in letter formation, with the standard letter forms adopted for the schools of New York City as the basis, uniformity of size, and regularity of correct slant.

"Under MOVEMENT, the specimens were judged as to quality of line. As is well known to students of penmanship, heavy, tremulous and broken lines are evidence of either finger movement or muscular movement that is too slow and deliberate to produce skill; and clear-cut, smooth lines are evidence of the use of the easy-flowing muscular movement that is desired.

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\*Bulletin No. 3, Brooklyn Training School for Teachers, The New York City Penmanship Scale, by C. C. Lister, January, 1919.

"Under SPACING, the writing was judged as to correct and uniform spacing between letters, between parts of letters and between words."

## 2. CONSTRUCTION OF THE SCALE

\*"The scale represents the average judgment of twenty-one teachers and penmanship experts in the muscular system of penmanship, and four psychologists. From nine schools of Greater New York, representative of the best, medium, and poorest product of the muscular system of penmanship, 3,550 specimens were selected from at least one entire class of each grade from 3B to 8B inclusive. Each specimen represented one trial from dictation."

"The specimens from each grade were classified into four piles by the writers on the basis of general merit and each pile was thoroughly mixed with its corresponding pile of the several grades. Then on the basis of chance three hundred specimens were selected so that practically the same number was drawn from each pile. According to written instructions each of the twenty-five judges ranked these specimens in eight piles on the basis of equal intervals in merit. Accordingly, each judge ranked the three hundred specimens three times, namely, as to form, spacing and movement.

"On the basis of the average rank assigned each specimen, the best and the poorest were selected as the top and the bottom of the scale. Therefrom the exact numerical rank which the other six samples should have was determined. The specimens whose average ranks are the same as these determined positions, or are nearest them were selected. Without exception all the samples on the scale are less than 0.1 from the *determined* position."

Figure 1 illustrates the resulting scale. The scale consists of twenty-four specimens arranged in parallel columns,—eight under Form, eight under Movement, and eight under Spacing. The scale values of the specimens under each element are 90, 80, 70—20. Four specimens under each element are reproduced below. These represent alternate steps beginning with 90.

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\* An Analytic Scale of Handwriting, by C. C. Lister and G. C. Myers, *Journal of Educational Psychology*, October, 1918.

## THE NEW YORK PENMANSHIP SCALE

FIGURE 1. FORM

90 One must exercise in work and in play Active play and almost all kind of work which children have to do, a good form of exercise. Long walks once or twice a week are good, but

This is good elementary school penmanship. Note the uniformity of size, slant, and alignment. The x is crossed carelessly.

70 One must exercise in work and play Active play and almost all kind of work which children have to do, are good forms

Good form. The curvature between letters is slightly exaggerated. Note the approach to a, d, and m.



50 One must exercise in work  
and in play. Active play and  
almost all kinds of work  
which children have to do, are  
good forms of exercise. Long

This writing slants too much. The t should not be looped. Note the careless tendency in completing k.

30 One must exercise in  
work and in play. Active  
play. And almost all kinds  
of work which children ha  
to do, are good. Forms of

This writing slants too much. The loops are too long and narrow. The t should not be looped. The a and d are poor.

FIGURE 1. MOVEMENT

90 One must exercise in work and in active play and almost all kinds of work which children have to do, a good form of exercise. Long walks or twice a week are good, but they are

The quality of line shown above is evidence of an easy muscular movement, which is produced by the muscles of the arm.

70 One must exercise in work and in active play and almost all kinds of work which children have to do, are good of exercise. Long walks once or twice a week are good, but they are not quite so good as

This shows good movement and fairly good control throughout. Note the sharp, clear-cut quality of line.

50

One must exercise in work and play. Active play and almost all kinds of work which children have to do, are good forms of exercise. Long walks once or twice a

The smooth and uniform quality of line indicates fairly good movement. The n, r, s, and k are poorly formed.

30

One must exercise in work and in play. Active play and almost all kinds of work which children have to do, are good forms of exercise.  
Long walks once or twice a week

Although the movement is poor, this writing shows a better quality of line than the specimen below.

FIGURE 1. SPACING

90 One must exercise in work and play. C  
play and almost all kinds of work which  
children have to do, are good forms of exer  
Long walks once or twice a week are good, -  
they are not quite so good as regular exer

This specimen shows a high degree of excellence in spacing. The writing, however, is too small.

70 One must exercise in work and in  
play. Active play and almost all  
kinds of work which children  
have to do are good forms of exer  
cise. Long walks once or twice

This spacing is quite clear, but it is too variable. Compare One, kinds and once.



50 One must exercise in work  
and in play. Active play and  
almost all kinds of work  
which children have to do  
are good forms of exercise.

This spacing is clear, but variable both within and between the words. The slant is variable.

30 Active play and all manner  
all kinds of work which  
have to do are good forms of  
exercise. Long walks. Once  
twice a week are good, but it

The separations between letters and between words are not clear. Some lines look like a long word.

## II. MEASURING PRESENT ACHIEVEMENTS IN PENMANSHIP

As a first step in the determination of grade standards for the New York Scale, the Bureau undertook to measure present achievements in penmanship in the schools. Penmanship tests were conducted in fifteen schools selected as representative of the whole system.

### 1. CONDUCT OF TESTS

*Uniformity of Conditions.* While it is comparatively simple to secure samples of the children's writing, particular care was taken to have uniform conditions obtain. The tests were given by thirty students from the New York Training School for Teachers who had had the course in educational measurements given in that school and also the normal course in muscular movement penmanship. These girls were familiar with the various scales in penmanship and had some experience in the conduct of standard tests. In addition they received practice in giving this penmanship test in accordance with formulated instructions, considerable attention being given to the question of "timing."

The children in the classes to be tested memorized on the day before the test the sentence that was used, viz., "One must exercise in work and in play." In the lower grades the class teachers gave attention to the word "exercise" in order to insure familiarity with its spelling by each child. The test consisted of writing repeatedly the above-mentioned sentence for two minutes. The class teachers took no part in the testing, although present in the rooms at the time.

The test was given in 500 classes, involving 18,000 children, in grades 4A to 8B. For purposes of this report about twelve thousand specimens were scored in full.

The scoring was done by training school students. The methods employed, the training of the judges and the reliability of the scoring that resulted are discussed in a later section of the report. (See Appendix A.)

### 2. GENERAL RESULTS

Table I shows the median scores obtained by each grade group throughout the city in each of the elements measured by the scale, form, movement, spacing and in rate of writing.

TABLE I—CITY-WIDE MEDIAN SCORES BY GRADES FOR FORM, MOVEMENT, SPACING AND RATE

Grades*	FORM	MOVEMENT	SPACING	RATE	No. of Pupils
	Median	Median	Median	Median	
8B	61	62	65	82	988
8A	57	61	63	83	1,117
7B	54	56	59	79	1,225
7A	55	56	59	78	1,327
6B	54	56	58	72	1,481
6A	51	53	56	69	1,414
5B	49	49	54	69	1,327
5A	45	45	51	66	1,529
4B	43	43	48	63	1,110
4A	38	40	48	58	241
City	51.3	52.9	56.4	72.5	11,759

\* The letter A designates the first half of the school year; the letter B the second half.

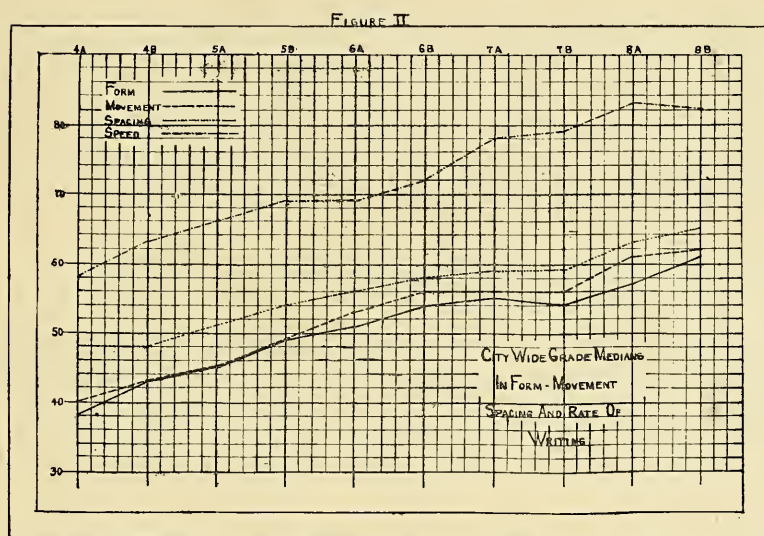


Figure 2 shows the above graphically. The vertical axis shows the rank on the scale and also indicates the rate in letters per minute. The horizontal axis shows the grades. For the city as a whole the median score for all the pupils tested is (without regard to grade) 51.3 in form, 52.9 in movement and 56.4 in spacing. This means that 50 percent. of the pupils tested, without regard to grade, obtained these scores or better. The table also shows that 50 percent. of all the pupils wrote at a rate of 72.5 or more letters per minute.

In order to show concretely the product of the schools in penmanship the following specimens of pupils' writing are presented. The size of the writing is somewhat reduced in the reproduction.

FIGURE 3. SAMPLE A, ILLUSTRATING THE TYPICAL PRODUCT OF THE BETTER HALF OF THE UPPER EIGHTH GRADE

One must exercised in work and  
in play. One must exercise in work  
and in play. One must exercise in  
work and in play. One must exercise  
in work and in play. One must  
exercise in work and in play  
One must exercise in work and in  
play One must

	Form	Movement	Spacing	Speed
Sample A.....	70	70	70	92
Q <sup>3</sup> .....	69	70	71	94

This sample was equaled or surpassed by 25 percent. of the pupils of the upper eighth grade.

FIGURE 4. SAMPLE B, ILLUSTRATING THE TYPICAL PRODUCT OF THE UPPER EIGHTH GRADE

in work and in play. One must exer  
cise in work. One must exercise in work  
and in play. One must exercise in  
work and in play. One must exercise  
in work and in play. One must exer  
cise in work and in play. One must  
exercise in work and in play. One  
must exercise in work.

	Form	Movement	Spacing	Speed
Sample B.....	60	60	65	82
Median.....	61	62	63	82

This sample was equaled or surpassed by 50 percent. of the 8B group.



Sample A, Figure 3, is the writing of an 8B boy, written at the rate of 92 letters per minute and judged to be of quality 70 in form, 70 in movement and 70 in spacing. It represents approximately writing that was equaled or surpassed by 25 percent. of the pupils in the 8B grade. The point in the 8B distribution which includes 25 percent. of the pupils, counted from the upper end, is called the third quartile. The third quartile is located at 68.8 in form, 70 in movement, 71 in spacing and 94 in speed.

Sample B, Figure 4, is the writing of an 8B girl, written at the rate of 82 letters per minute and judged to be of quality 60 in form, 60 in movement and 65 in spacing. It approximately represents median performance for the 8B grade, that is writing which was equaled or surpassed by 50 percent. of the 8B pupils. The median for the 8B is 61 in form, 62 in movement, 63 in spacing and 82 in speed.

The 25 percent. point in the distribution calculated from the lower end is called the lower quartile or first quartile. In the 8B grade this was 53 in form, 53 in movement, 58 in spacing and 68 in speed. Sample C, figure 5, represents an 8B pupil's writing which approximates these values; 25 percent. of the 8B pupils wrote as poorly or worse than this sample and at a slower rate.

FIGURE 5. SAMPLE C, ILLUSTRATING THE TYPICAL PRODUCT OF THE POORER HALF OF THE UPPER EIGHTH GRADE

*One must exercise in work  
and in play. One must exercise in  
work and in play One must  
exercise in work and in play  
One must exercise in work  
and in play One must X*

	Form	Movement	Spacing	Speed
Sample C.....	55	50	55	64
Q <sub>1</sub> .....	53	53	53	68

This sample was equaled or surpassed by 75 percent. of the pupils of the upper eighth grade.

The above samples may be used also to illustrate the results obtained in the other grades.

### 3. RATE OF WRITING

Examining the data more in detail let us consider first the rate of writing. The specimens of penmanship obtained from the test were scored for rate of writing by some of the training school pupils who had served as examiners. In such scoring they made use of mimeographed copies of the test sentence upon which there was a count of the letters. The number of letters written for two minutes thus determined was reduced to the rate per minute.

TABLE II—DISTRIBUTION OF INDIVIDUAL SCORES FOR RATE OF WRITING

Letters per minute	GRADES										Total	Percent. of total	Cumulative percent.
	4A	4B	5A	5B	6A	6B	7A	7B	8A	8B			
150	.....	.....	.....	.....	1	.....	.....	5	.....	.....	6	0.05	0.05
140	.....	.....	.....	.....	.....	.....	.....	6	.....	.....	6	0.05	0.1
130	.....	.....	.....	1	.....	1	2	3	2	3	12	0.1	0.2
120	.....	.....	3	4	6	14	18	27	21	15	108	0.9	1.1
110	1	1	2	7	8	21	32	29	53	32	186	1.6	2.7
100	.....	13	23	32	56	101	115	98	119	92	649	5.5	8.2
90	1	41	105	116	117	172	200	219	224	188	1,383	11.8	20.0
80	7	69	158	148	152	181	217	210	185	192	1,519	12.9	32.9
70	38	216	341	329	325	324	367	282	256	189	2,667	22.7	55.6
60	63	323	363	320	327	286	223	214	149	130	2,398	20.4	76.0
50	51	198	221	153	186	150	99	72	58	69	1,257	10.7	86.7
40	61	170	178	151	177	144	39	44	40	60	1,064	9.0	95.7
30	16	69	101	52	49	72	12	15	10	14	410	3.5	99.2
20	3	9	28	11	8	15	3	1	.....	3	81	0.7	99.9
10	.....	1	6	3	2	.....	.....	.....	.....	1	13	0.1	100.0
Total	241	1,110	1,529	1,327	1,414	1,481	1,327	1,225	1,117	988	11,759	100.0	.....

Table II gives the distribution of the scores of all pupils by grades. The next to the last column of Table II shows the percent. of all pupils that wrote at each rate of speed. Such data reduced to a millenary basis in figure 6 shows that out of every thousand pupils tested 1 wrote at the rate of 140 or more letters per minute, 1 at 130 or more letters, 9 at 120, 16 at 110, and so on down to 35 who wrote less than 40 letters, 7 less than 30 and 1 less than 20 letters per minute.

The last column on Table II shows the cumulative percent. ranging from the top downward. It shows, for instance, that 82 out of every thousand or 8.2 percent. wrote 100 or more letters, that 20 percent. wrote 90 or more, that 32.9 percent. wrote 80 or more, and 55.6 percent. wrote more than 70 letters per minute. The standard speed set up by Ayres for the eighth year is 80 letters, which is equaled or exceeded by 32.9 percent. of all the pupils. Two hundred pupils out of every thousand or 20 percent. equal or surpass the

standard rate of 90 letters set up by Freeman for the eighth year. The above disregards grade distinctions and shows that the New York pupils are rapid writers.

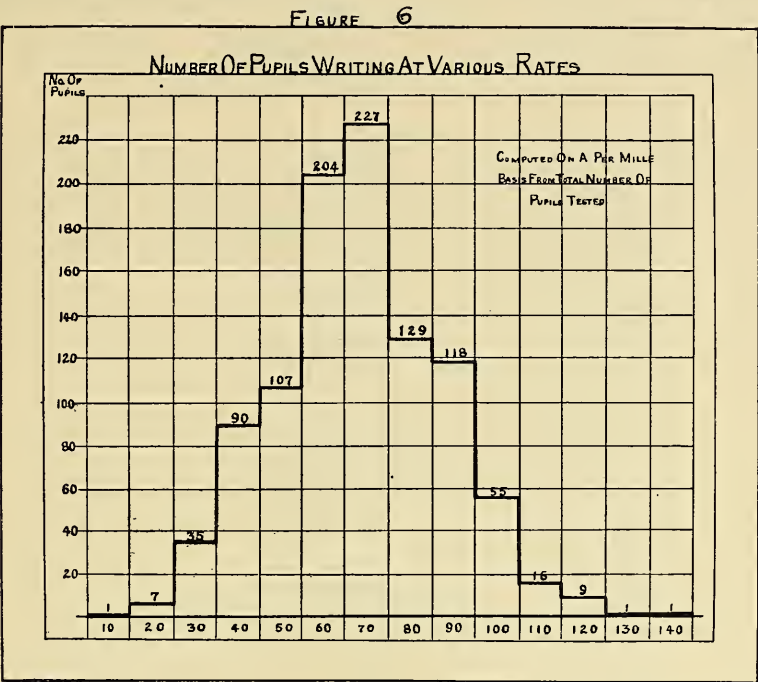
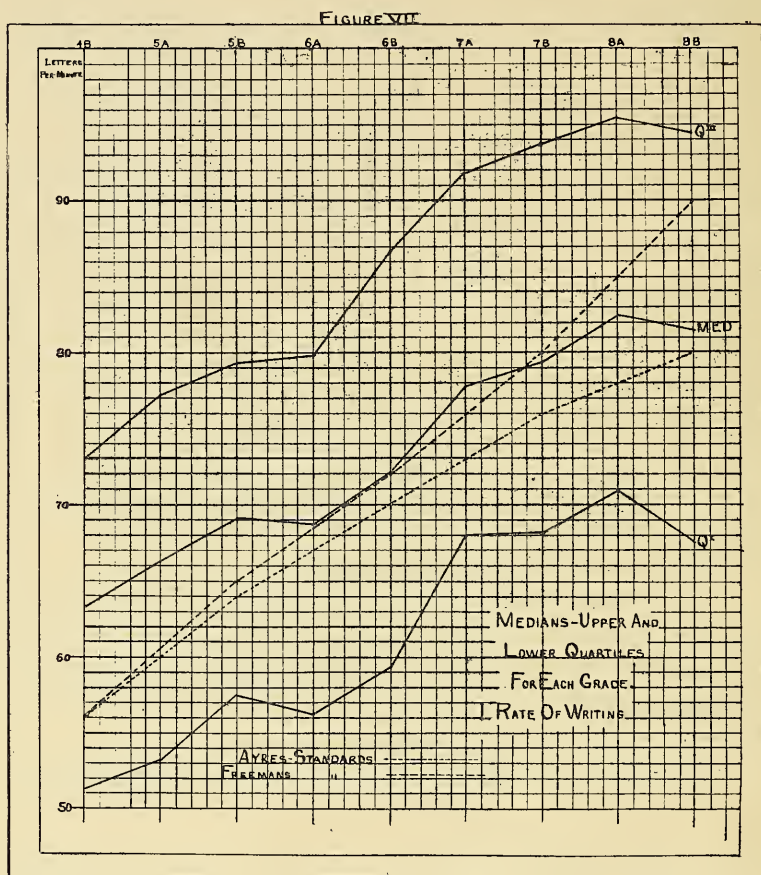


Table III, which follows, gives the median rate for each grade, the rates for the upper quartiles and the lower quartiles and the range of the middle 50 percent. of the group. It also gives, for comparative purposes, standards set up by Ayres and by Freeman and the results obtained in the Cleveland Survey.

TABLE III—GRADE MEDIAN RATES, UPPER AND LOWER QUARTILES

Grades	4B	5A	5B	6A	6B	7A	7B	8A	8B
Q <sup>3</sup>	73.0	77.3	79.3	79.8	86.7	91.8	93.7	95.4	94.4
M	63.3	66.3	69.1	68.7	72.2	77.8	79.4	82.5	81.5
Q <sup>1</sup>	51.4	53.1	57.5	56.3	59.3	68.0	68.1	70.9	67.7
Range Middle 50percent.	21.6	24.2	21.8	23.5	27.4	23.8	25.6	24.5	26.7
Freeman Standards	56	65		72		80		90	
Ayres Standards	56	64		70		76		80	
Cleveland Survey	....	60		70		76		80	

Figure 7 shows the above data graphically. It appears that the median rate of writing increases irregularly from grade to grade rising from 63 letters per minute in the 4B grade to 82 in the second half of the 8th year.\* There is no gain shown in the 6A grade over the 5B while in the 8B the rate is slightly lower than that of the grade below. The greatest gain appears in the 7A.



New York children are by no means slow writers. Their rates are higher than the scores obtained in other surveys and exceed in all years the standards set up by Ayres. With the exception of the last three half years the median scores are higher than the standards fixed by Freeman, which were based upon the average of the better half of the schools tested by him.

\* The data obtained for the 4A grade will be disregarded because of the small number of pupils tested.



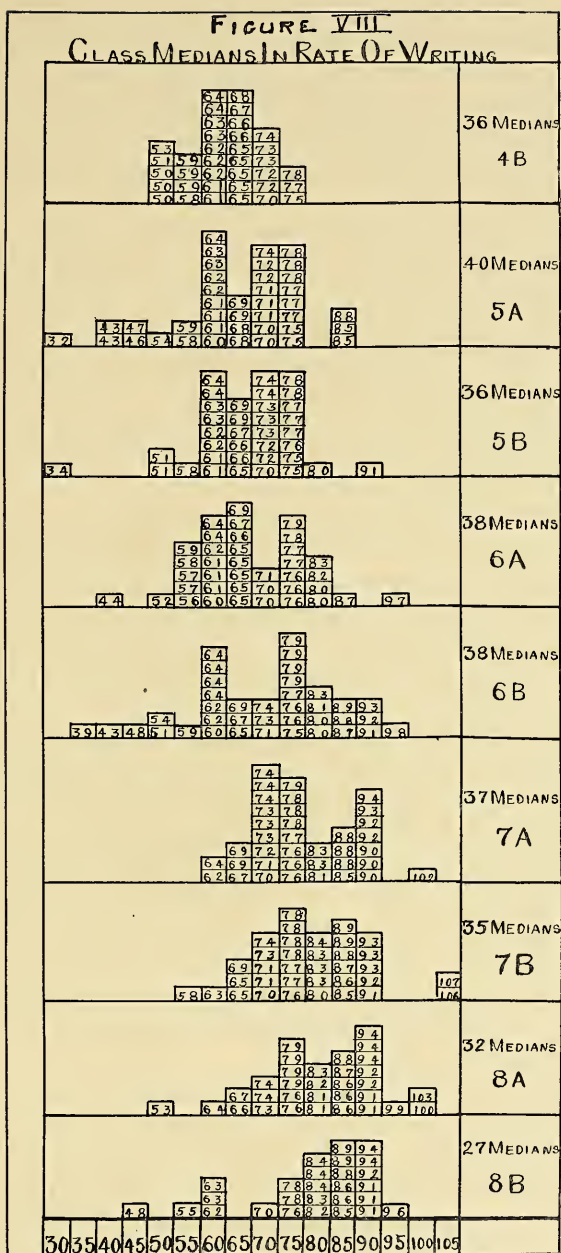


Figure 8 shows by grades the medians for each class in rate of writing. Each square represents a class and the figure within the square is the median score attained by that class. The scores are

arranged in intervals of five. For instance, in the top figure, the 4B grade, there were three classes with medians of 50, one with 51, one with 53, and so on. The slowest class obtained 50 and the most rapid 78. The classes in this grade are closely bunched. In the 5A the slowest class score is 32 while that of the most rapid is 88, more than twice as large. It is to be noted that the majority of the classes are above 60.

As we go up through the grades the central tendency moves toward the right and the lower scores drop off. The diagrams show the great variability in performance by classes within the same grade, in many cases within the same school. Grade distinctions have little significance when one considers the marked overlapping that is revealed. In each grade quite a large number of classes could be replaced by an equal number of classes from a higher or from a lower grade without seriously affecting the grade distribution as far as speed or rate of writing is concerned.

It is to be borne in mind that we are dealing not with scores of individual pupils but with class groups. The variability cannot be attributed to individual differences in ability but must be charged to lack of uniform grade standards in our instruction. While such conditions are significant they are not surprising and have been shown in a number of studies in other school systems and in other subjects besides penmanship.

Some index of the degree to which the grades overlap is obtained by comparisons of the upper quartiles of different grades with the median rate of higher grades (see Table III). For instance, the upper quartile for 4B is 73.0 which is a higher rate than the median of the 6B grade, 72.2, four grades above. In other words, 25 percent. of the 4B children write faster than 50 percent. of the 6B children. Likewise, 25 percent., at least, of the 5A children write a good deal faster than 50 percent. of the 6B grades; 25 percent. of the children in the 5B attain a speed of 79.3 and exceed the rate of 50 percent. of the 7B children, and 25 percent. of the 6B group write faster than 50 percent. of the eighth year group.

Comparing the lower quartiles of different grades with the median of lower grades we see, for instance, that in the 8B grade 25 percent. of the pupils write more slowly than 50 percent. of the 5B grade, six grades lower. Similarly 25 percent. of the 6B grade write at a rate which fails to equal the median of the 4B grade, four grades below.

Reverting to the grade distributions again (Table II) which shows the individual scores in each grade, we see even greater variability between the rates of writing of children within the same grade. In all grades practically the same range is required to express the

rates obtained by the individual pupils. In the 4B the rate varies from that of one pupil who wrote less than 20 letters per minute to one who wrote more than 110 letters per minute. In the 7B grade the rates range from that of the slowest pupil who wrote at a rate of less than 30 up to five pupils who exceeded 150 letters.

As far as rate of writing is concerned grade distinctions mean nothing. To say a pupil is in the 8B indicates little as to his speed of writing. He may write very fast or he may write at a slower rate than the average of the 4B pupils.

The condition revealed indicates an absolute lack of grade standards. It does not necessarily mean that emphasis has been put upon speed but rather does it indicate that no particular attention has been paid to controlling the rate at which children write. The children who began as slow writers probably continued as slow writers throughout the grades, with only such increase as may come from increased age or maturity. The fast writers in the lower grades probably continue likewise to write at a rapid rate throughout.

While writing of a good quality is a prime requirement, instruction should also seek to improve the rate of writing, particularly of the slower writers. Less than 80 letters per minute is slow writing. The presence of numbers of pupils in the last year of the course who fail to attain a speed of 60 letters per minute indicates the failure of our instruction to give pupils about to leave school writing habits which will meet the requirements of the outside world. The presence of pupils in all grades who write at very rapid rates again indicates the need of control so that the quality of the writing of such pupils is not sacrificed for the sake of speed. Rapid writing must be accompanied by satisfactory quality.

#### 4. QUALITY OF WRITING

##### (a) FORM

How well do New York pupils write? The specimens of writing were scored for form, movement and spacing by means of the New York Penmanship Scale.

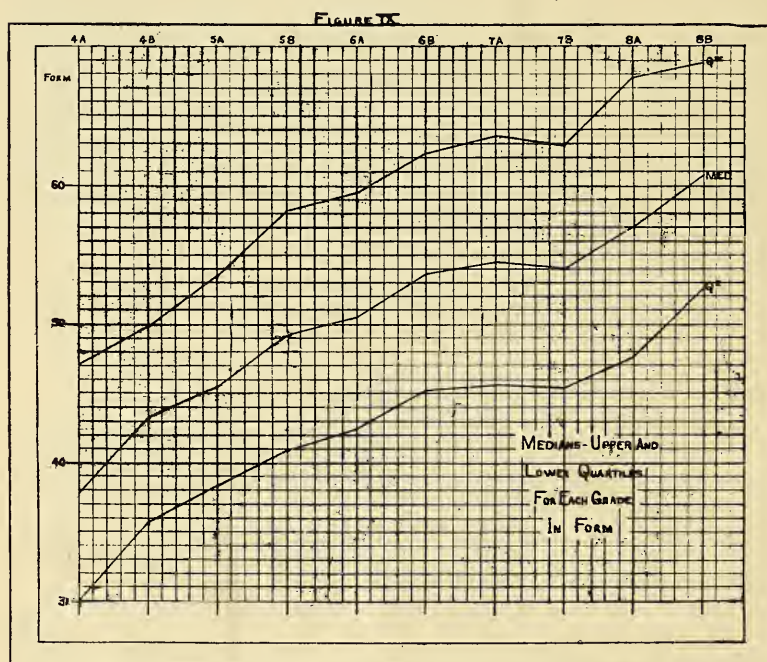
Under "Form" were considered the letter formation, uniformity of size and regularity of correct slant.

Table IV shows for form the medians, the upper and lower quartiles and the range of the middle 50 percent. in each grade. Figure 9 shows these figures graphically.

TABLE IV—GRADE MEDIANS, UPPER AND LOWER QUANTILES IN FORM

Grade	4A	4B	5A	5B	6A	6B	7A	7B	8A	8B	City
$Q^3$	47.1	49.8	53.4	58.2	59.5	62.3	63.6	62.9	67.8	68.8	....
Median	37.9	43.2	45.4	49.2	50.5	53.7	54.5	54.0	57.0	60.8	....
$Q^1$	30.0	35.8	38.3	40.9	42.4	45.2	45.6	45.4	47.7	52.6	....
Range of Middle 50 percent.	17.1	14.0	15.1	17.3	17.1	17.1	18.0	17.5	20.1	16.2	....
Grade interval between medians	5.3	2.2	3.8	1.3	3.2	0.8	0.5	3.0	3.8		

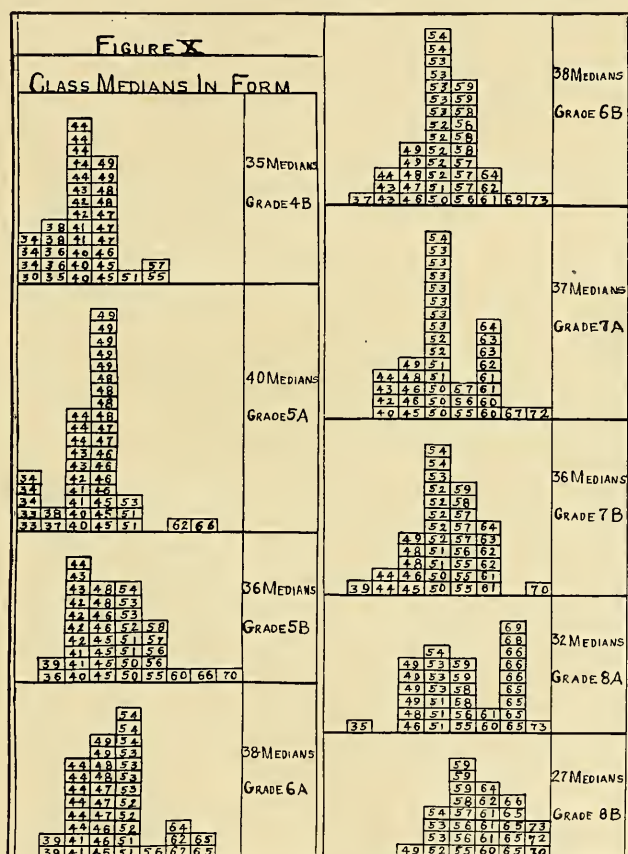
The grade medians for form show a slight irregular progress from grade to grade, varying from 37.9 in 4A to 60.8 in grade 8B. Improvement is shown from the 4A up to the 6B. In the 6B, 7A and 7B the form remains practically on a level. In the 8A and 8B the medians show a gain. The average grade interval is but 2.5 points or about one-fourth of a step on the scale. The total difference between the 4B and 8B medians is a little more than 20 points or two steps on the scale.





In most of the grades the range of the middle 50 percent. of the group approximates the total median improvement between the lowest and highest grades. In other words, considering only the middle 50 percent. of the children we find there is approximately as great a difference in any grade between the upper and lower quartiles as there is between the medians of the 4B and the 8B grade.

The results by classes in each grade are presented in Figure 10. Each square shows a class and the figure within the square represents its median score. The 35 classes tested in the 4B, it will be seen in the top diagram, range from 30 for the lowest up to 57 for the highest. The great majority of classes are found in the "forties." The 5A grade shows greater variation. Here the range is from 33 up to 66. The class with the lowest score does only half as well as the highest class. The central tendency here is in the group 45 to 49.



The advance from grade to grade is seen by the gradual shifting of the central tendency to the right, that is toward a higher score



and also by the falling away of the lower scores in the upper grades. At the same time the variation in class performance is typical of each grade and the overlapping of grades is quite marked. The overlapping of grade and grade may be roughly indicated by a comparison of the upper quartile of one grade with the medians of higher grades, and by a similar comparison of the lower quartile with the medians of lower grades. Table V shows such a comparison.

TABLE V—COMPARISON OF QUARTILES WITH MEDIANS TO SHOW OVERLAPPING

Lower Quartiles		MEDIANS										Upper Quartiles	
		4A	4B	5A	5B	6A	6B	7A	7B	8A	8B		
		37.9	43.2	45.4	49.2	50.5	53.7	54.5	54.0	57.0	60.8		
4A	30.0		3.9	2.3	.....	.....	.....	.....	.....	.....	.....	47.1	4A
4B	35.8	-2.1		4.4	0.6	.....	.....	.....	.....	.....	.....	49.8	4B
5A	38.3		-4.9		4.2	2.9	.....	.....	.....	.....	.....	53.4	5A
5B	40.9		-2.3	-3.6		7.7	4.5	3.7	4.2	1.2	.....	58.2	5B
6A	42.4		-0.8	-3.0	-6.8		5.8	5.0	5.5	2.5	1.5	59.5	6A
6B	45.2			-0.2	-4.0	-3.6		7.8	8.3	5.3	1.5	62.3	6B
7A	45.6				-3.6	-4.6	-8.1		9.6	6.6	2.8	63.6	7A
7B	45.4				-3.8	-5.1	-8.3	-9.1		5.9	2.1	62.9	7B
8A	47.7				-1.5	-2.8	-6.0	-6.8	-6.3		7.0	67.8	8A
8B	52.6						-1.1	-1.9	-1.4	-4.4		68.8	8B

In Table V the medians for the various grades are given across the top, the lower quartile is shown in the left hand column, and the upper quartile in the last column on the right.

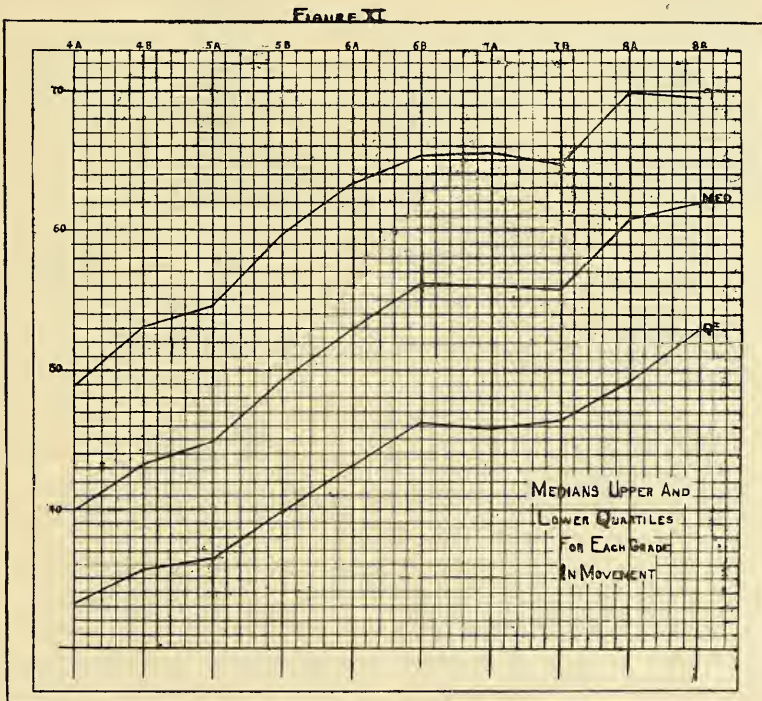
The figures to the right of the heavy line show how much the upper quartile of a given grade exceeds the median of the grades above. The figures to the left show how much the lower quartile of a given grade falls below the median of lower grades. For instance, the median of the 5B grade is given at the top as 49.2, the lower quartile is given at the left as 40.9. Reading horizontally across from 5B to the left of the heavy line shows that the lower 25 percent. of the 5B groups fails to reach the median of the 4B grade by 2.3 points and the median of the 5A grade by 3.6 points. The figures on the same line to the right of the heavy line show that the upper quartile of the 5B exceeds the 6A median by 7.7 points, the 6B median, two grades above, by 4.5 points, the 7A median by 3.7 points the 7B median by 4.2 points, and that of the 8A, five grades above, by 1.2 points. Similarly for the other grades. In the 8B we find that the poorest writers do not write as well as the average writers of the 6B, several grades below.

(b) MOVEMENT

Under the element of movement was considered the quality of line on the assumption that the character of the movement would be indicated by the quality of line. Table VI shows for each grade the medians, the upper and lower quartiles and the range of the middle 50 percent. in the element of movement. Figure 11 shows these data graphically.

TABLE VI—GRADE MEDIANS, UPPER AND LOWER QUANTILES IN MOVEMENT

Grade	4B	5A	5B	6A	6B	7A	7B	8A	8B	City
$Q^3$	53.1	54.6	59.7	63.3	65.3	65.5	64.7	69.9	69.6	63.5
Median	43.3	44.8	49.3	52.9	56.1	56.0	55.7	60.8	62.0	52.9
$Q^1$	35.7	36.4	39.8	43.1	46.3	45.9	46.4	49.2	52.9	42.2
Range of middle 50 percent.	17.4	18.2	19.9	20.2	19.0	19.6	18.3	20.7	16.7	21.3
Intervals between grade medians.....	+1.5	+4.5	+3.6	+3.2	-0.1	-0.3	+5.1	+1.2		



The grade medians for movement show an irregular progress from grade to grade rising from 39.9 in 4A to 62.0 in 8B. The extent of improvement is slight. In the 7A and 7B there is a slight loss which is made up by the gain of 5 points in the 8A, the largest grade increase. The average gain per grade is but 2.5 points or one-fourth of a scale step. The total difference between the 4A and 8B medians is but 22 points or a little more than two steps on the scale.

Here again, as in form, the range of the middle 50 percent. of the group in most of the grades is almost as great as the difference between the medians of the highest and lowest grades.

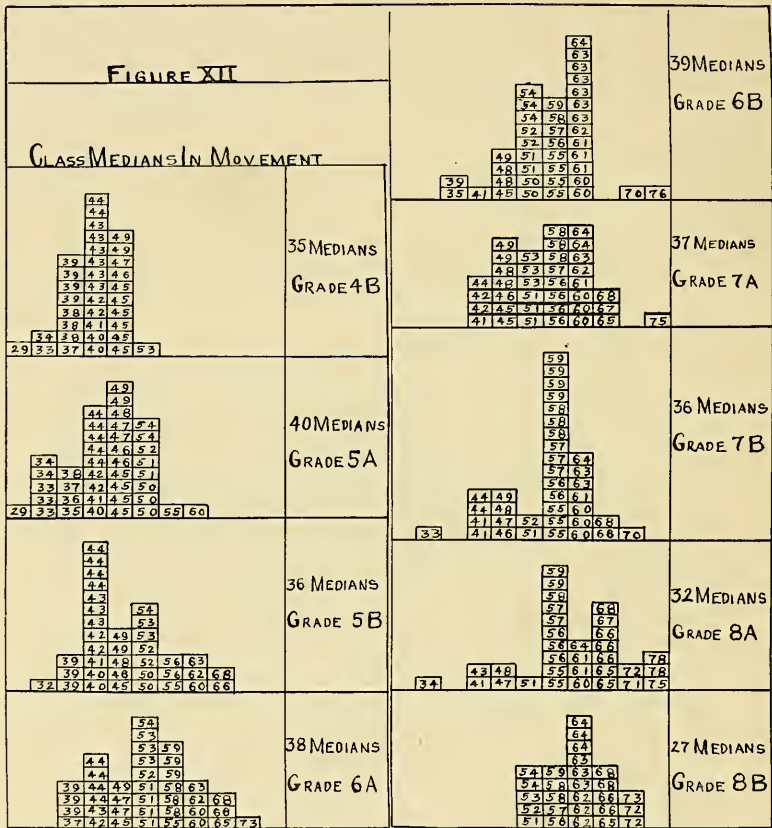


Figure 12 shows by grades the distribution of class scores. In the 4B grade, for instance, out of the thirty-five classes tested the lowest class received the score of 29 and the highest class scored 53. The greatest number of classes are concentrated in the forty and forty-five columns. The range of class scores is quite wide in all

grades. In the 8B it is narrowest. The variability in the performance of the classes and the overlapping of the grades are readily apparent. The situation in movement is the same as that revealed in form.

A comparison of the upper and lower quartiles shows likewise the extent to which grade distinctions are without significance in this subject. The upper quartile of the 4B exceeds the median of the 6A, three grades above. The upper quartile of the 6A exceeds the median of the 8B and so on. On the other hand, the lower quartile of the 8B is just equal to the median of the 6A and is less than the median scores of the intervening grades. The lower quartile of the 8A is lower than the median of the 5B. In the same way the lower 25 percent. of the 6A group write worse than 50 percent. of the 4B.

### (c) SPACING

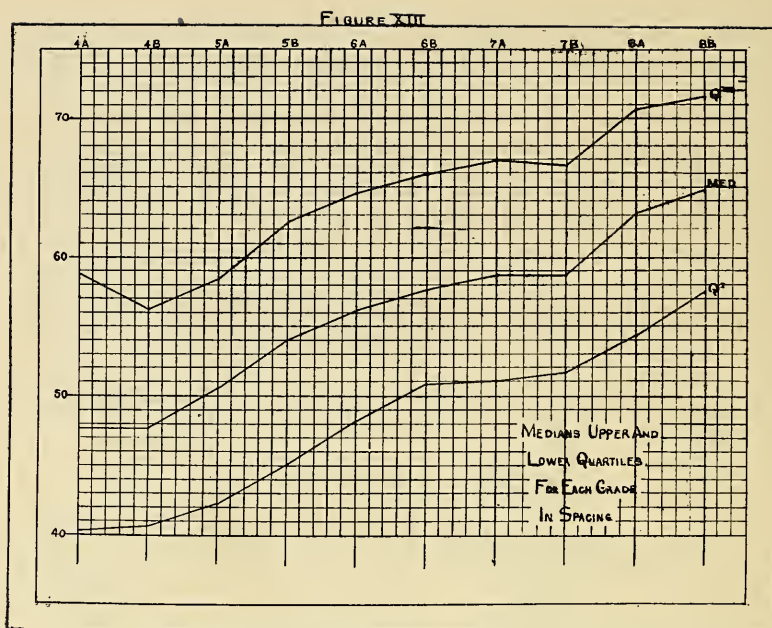
Spacing includes the elements of uniform spacing of letters, of parts of words and of words. Table VII gives the city wide median scores for each grade group in this element. It also shows the upper and lower quartiles and the range of the middle 50 percent.

TABLE VII—GRADE MEDIANS, UPPER AND LOWER QUANTILES IN SPACING

Grade	4B	5A	5B	6A	6B	7A	7B	8A	8B	City
Q <sup>3</sup>	56.3	58.4	62.5	64.6	65.9	66.9	66.6	70.7	71.6	65.5
Median	47.7	50.5	54.0	56.2	57.7	58.7	58.7	63.2	64.8	56.4
Q <sup>1</sup>	40.6	42.2	45.0	48.2	50.8	51.0	51.6	54.3	57.5	47.5
Range of middle 50 per cent.	15.7	16.2	17.5	16.4	15.1	13.9	15.0	16.4	14.1	18.0
Interval between grade medians.....	+2.8	+3.5	+2.2	+1.5	+1.0	0.0	+4.5	+1.6		

Figure 13 shows the same data graphically. With the exception of the 7B grade the medians of each grade show an increase, from 47.7 for the 4B to 64.8 for the 8B. The total increase between the 4B and the 8B grades is but 17 points, less than two steps on the scale. This is approximated by the range in scores of the middle 50 percent. in almost each grade. The average grade increment is a very small part of a scale step.





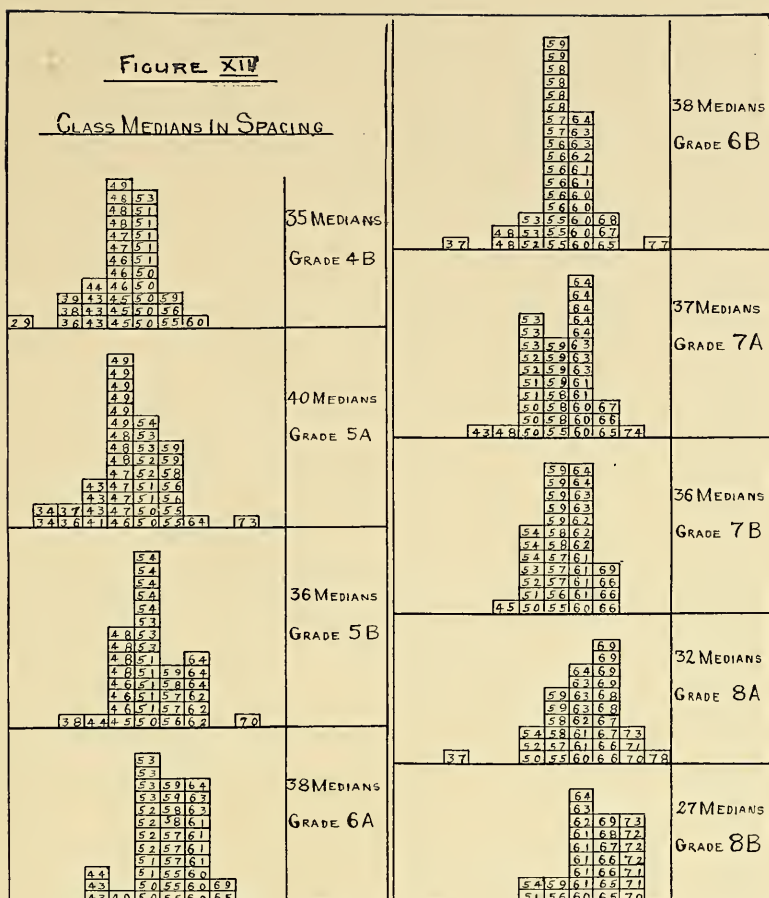
Inspection of the quartile and the median scores, as with the other elements, again shows what little significance grade distinctions possess. The upper 25 percent. of the 5A group do better than the lower 25 percent. of the 8B grade. Fifty percent. of the 8B pupils do poorer than 25 percent. of the 6B. Twenty-five percent. of the 8B fail to get as high scores as 50 percent. of the 6B, four grades below.

The above data are for the grade groups throughout the city. For the individual classes the scores are shown in Figure 14. As in the other elements the marked characteristic is the variation between classes, in many cases as great a difference being present as was found between the 4B and the 8B grade groups for the whole city. Again, also the overlapping of the grades shows up in marked degree. Such data are class scores and not the scores of individuals.

#### 4. RELATION OF SPEED AND QUALITY

The previous sections of the report considered the results in terms of speed and of the elements of quality alone. A very important question to be considered in examining the results is the relation between quality and speed. It is possible for us to set up grade norms for the various elements of quality, norms which may be achieved but at the expense of speed. At the same time we may establish certain norms for speed which also may be attained





but at the expense of good form or other characteristics of quality. Satisfactory quality must be attained but must be accompanied by satisfactory rates of writing.

From Table II which showed the medians in each characteristic of quality and also in rate, it may be noted that speed increased with one or two exceptions from grade to grade. At the same time the median scores in form, in movement and in spacing also increased from grade to grade. There was a certain degree of correspondence as far as the whole grade groups were concerned between the median speed and the median scores in quality from grade to grade.

Does such relation hold within the grades? In order to determine this the average speed was determined for each scale score in each grade in form, movement and spacing. Table VIII shows for each grade the average speed at which each quality in form was written.

TABLE VIII—AVERAGE RATE IN EACH GRADE FOR EACH STEP ON SCALE IN FORM

Grade	SCORE IN FORM															
	20		30		40		50		60		70		80		90	
4B..... No..... Av. Rate.....	91	63	321	64	431	63	195	62	52	59	17	49	3	48	....	....
5A..... No..... Av. Rate.....	94	73	346	71	599	66	313	62	124	59	45	52	8	45	3	48
5B..... No..... Av. Rate.....	58	76	235	72	404	72	362	67	169	63	92	60	7	61	....	....
6A..... No..... Av. Rate.....	35	75	211	71	440	72	394	69	213	65	106	63	15	58	....	....
6B..... No..... Av. Rate.....	23	82	140	77	397	75	482	73	295	68	126	62	18	56	....	....
7A..... No..... Av. Rate.....	25	87	119	85	336	82	408	80	297	76	121	73	20	73	1	45
7B..... No..... Av. Rate.....	26	104	103	90	325	85	398	79	234	76	122	75	17	75	....	....
8A..... No..... Av. Rate.....	8	95	87	90	238	89	320	83	237	82	193	75	31	77	3	65
8B..... No..... Av. Rate.....	2	115	41	83	126	86	300	82	310	79	178	77	31	77	....	....

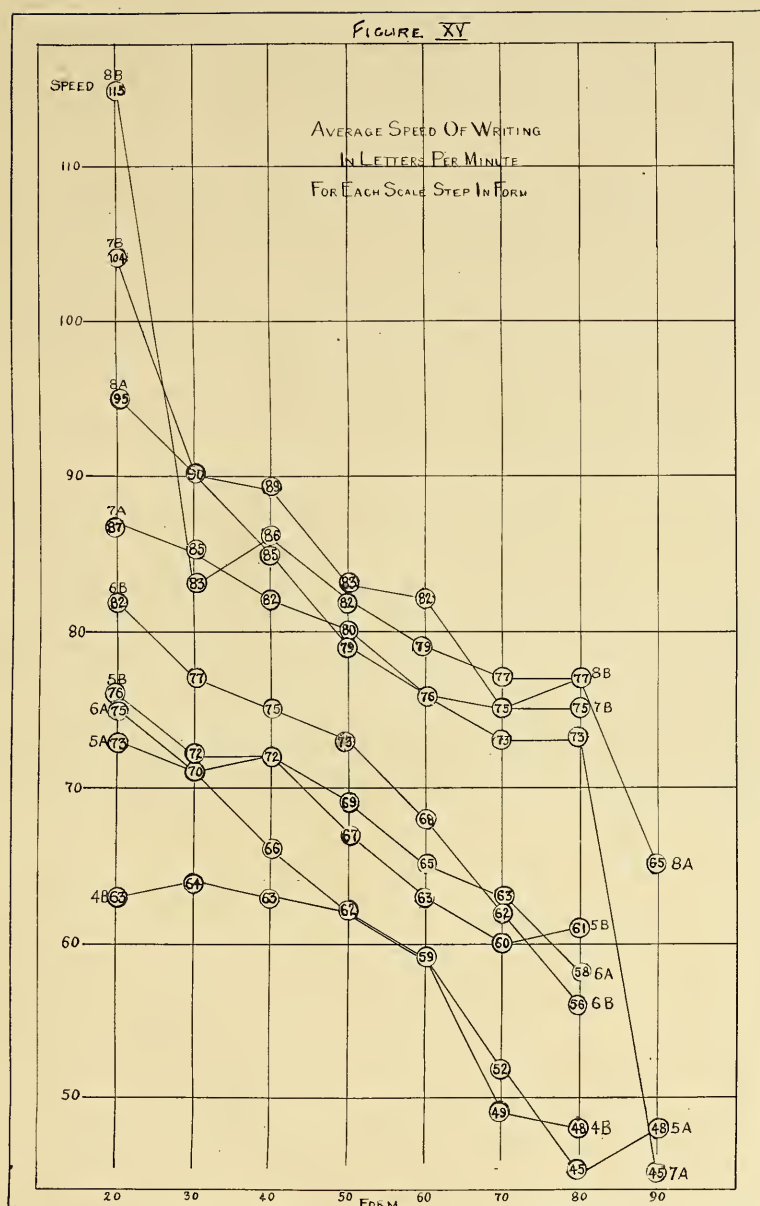


Figure 15 shows graphically for each grade the data contained in Table XVII. The vertical axis represents speed in letters per minute. The horizontal axis represents ascending steps in form. From the diagram it will be noted that in the 4B grade, for instance, the pupils scoring 80 in form wrote at an average rate of 48 letters a

minute. On following the line toward the left it is seen that the rate for those scoring 70 in form was 49 letters per minute, for those scoring 60 the rate on the average was 59 letters, for those scoring 50 the rate was 62 letters and so on. Similarly for the other grades.

There appears to be a general tendency toward decrease of speed as form improved. In the 4B grade it will be noticed, however, that the speed averaged fairly constant up to the 60 step and then declines rapidly for the upper ranges in form. Higher quality evidently is attained at the sacrifice of speed. In the 7th and 8th years also the speed shows quite a constant average from 50 steps upward. The higher rates of speed are accompanied by lower scores in form. Here it appears that the greater speed results in poorer form.

Table IX shows similar data for the element of movement and is illustrated by figure 16.

The same general tendency toward a decrease in quality with increased rate of writing is revealed. At the same time it appears in some of the grades that with the intermediate ranks or steps in movement, the averages for speed remain fairly constant. For instance, in the 8B grade for the scale step from 30 to 80 the rates are 85, 83, 81, 79, 80, 78. In the 8A for the steps from 40 to 70 in movement the rates are 84, 84, 80, 83. In the 4B also the rates of speed are practically the same for all ranks on the scale except the very extremes. For the steps from 30 to 60 inclusive the rates are 64, 63, 62, 60. While an inverse relationship is shown it does not appear to be very large.





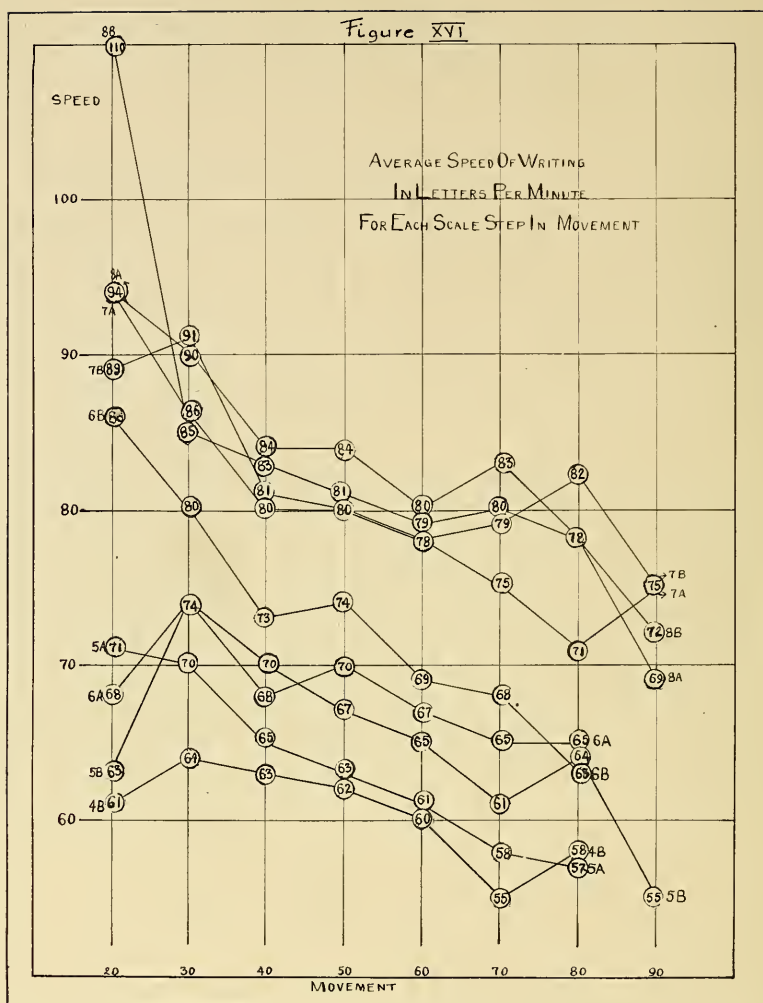
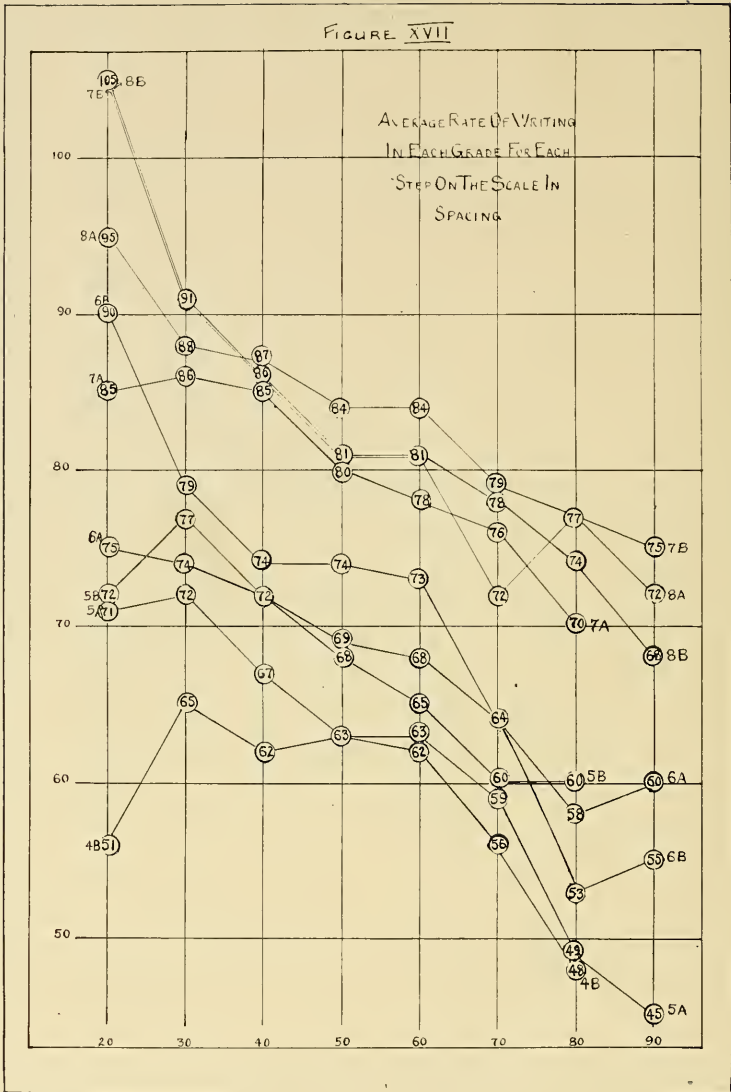


Table X and Figure 17 show similar data for the element of spacing. The data for spacing show in general an inverse relation between speed and spacing with an intermediate area from ranks 40 to 60 where no correlation is apparent.

TABLE X—AVERAGE RATE OF WRITING IN EACH GRADE FOR EACH STEP ON THE SCALE IN SPACING

Grade		SCORE IN SPACING															
		20		30		40		50		60		70		80		90	
4B.....	No.....	27	56	229	65	388	62	301	63	123	62	39	56	3	48	....	....
	Av. Rate																
5A.....	No.....	25	71	259	72	455	67	488	63	212	63	67	59	21	49	2	45
	Av. Rate																
5B.....	No.....	12	72	166	77	308	72	441	68	272	65	111	60	17	60	....	....
	Av. Rate																
6A.....	No.....	4	75	123	74	275	72	494	69	358	68	133	64	25	58	2	60
	Av. Rate																
6B.....	No.....	6	90	80	79	244	74	535	74	421	73	155	64	38	53	2	55
	Av. Rate																
7A.....	No.....	2	85	84	86	203	85	430	80	399	78	176	76	33	70	....	....
	Av. Rate																
7B.....	No.....	2	105	56	91	178	86	432	81	380	81	139	72	37	77	1	75
	Av. Rate																
8A.....	No.....	2	95	58	88	102	87	270	84	391	84	222	79	65	77	7	72
	Av. Rate																
8B.....	No.....	1	105	17	91	65	86	218	81	404	81	219	78	61	74	3	68
	Av. Rate																

FIGURE XVII



To obtain a clear and more exact determination of the relation existing between the elements of speed and form, movement and spacing, than was afforded by the analysis presented in the preceding section, the degree of correlation between the several characteristics or elements was computed. Instead of treating all of the data involved in the scores of the 12,000 pupils, two sets of 1,000 specimens each were selected by a process of sampling.

The product moment formula was used in the computation of the coefficient of correlation with the following results:

TABLE XI—COEFFICIENTS OF CORRELATIONS BETWEEN THE SEVERAL ELEMENTS

Elements	1ST SAMPLING		2D SAMPLING	
	r	P. E.	r	P. E.
Form and movement.....	+.75	.0093	+.749	.0092
Form and spacing.....	+.73	.0094	+.738	.0097
Movement and spacing.....	+.72	.0101	+.716	.0103
Speed and form.....	-.056	.02	-.054	.02
Speed and Movement.....	-.036	.02	-.029	.02
Speed and spacing.....	-.013	.0213	-.016	.0213

The correlation between speed and the elements of form, movement and spacing is negligible. The fact that the probable error is as large or larger than  $r$  indicates the unreliability of our result. It appears then that there is little relation between speed and the different elements of quality in writing. The fast writers write a good hand as well as the slow writers. The good writers write rapidly as may also the poor writers.

In the case of the other elements a high degree of positive correlation is shown. This indicates that an increase in form would be accompanied by an increase respectively in movement and in spacing and vice versa.

## 6. RELATIVE EMPHASIS ON QUALITY AND SPEED IN DIFFERENT SCHOOLS

The results of our test already presented have clearly indicated the variability of achievement in the various classes and grades. It has been shown that there is apparently an absolute lack of uniform standards of achievement in the various grades and even among classes within the same grade. In this section data will be presented showing the relative emphasis placed upon speed and upon quality in some of the schools tested.

In order to show the development in penmanship through the grades, the progress in quality and the progress in speed may be shown under one diagram. For quality the grade median scores in

form, movement and spacing were averaged to obtain a single score. The resulting curves would not be materially different if we were to take only one element at a time.

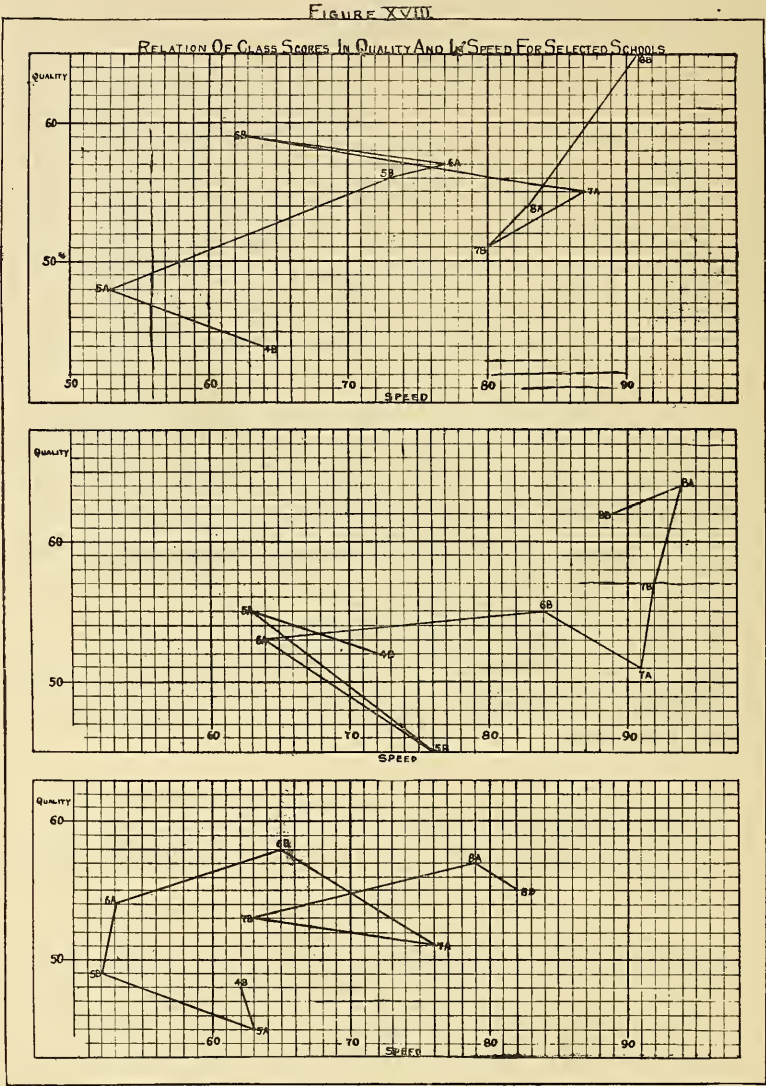


Figure 18 shows the progress from grade to grade in three selected schools. The horizontal axis shows speed. Distance to the right indicates progress in speed. The vertical axis measures quality and distance upward indicates progress in quality. In inter-



preting the diagrams we must bear in mind that the distance between the horizontal axes measures only ten points or one step on the penmanship scale, and that distance between the vertical axes represents but ten letters.

The top diagram of figure 18 represents a school which shows considerable progress in quality from the 4B to the 6B. The score in 4B in quality is 44, in the 5A it is 48, in 5B, 56, in 6A, 57, and in 6B, 59. At the same time it is apparent that no effort has been made to control the speed in those grades. The 5A grade shows a loss in speed of 11, the 5B makes a large gain over the 5A, from 53 to 73. There is a further gain in the 6A and then a considerable loss in the 6B, a drop from 77 to 63. The last two years show a gain in speed but with the exception of the 8B, a loss in quality from the level reached by the 6B. The course of study does not prescribe penmanship in the last two years. This, together with the increased demands in the upper grades for rapid writing, may explain in part the situation revealed.

The middle graph in Figure 18 shows another instance of irregular development. In this school the 4B scored 52 in quality and 72 in speed, the 5A scored 55 in quality, a gain of 3 points but only 63 in speed, a loss of nine letters. The 5B shows a drop in quality from 55 to 45 but a gain in speed. The 6A makes up partly for the loss in quality by a gain of 8 points, scoring 53 which is below the 5A score. The 6B grade score shows a very large gain in speed but just equals the 5A in quality. From the 4B to the 6B the net result is a gain of only 3 points in quality. From the 7A on the curve turns sharply upward and the apparent emphasis on quality results in a considerable gain, from 51 to 64, but is accompanied by only a slight gain in speed. The 8B with a score of 62 in quality and 88 in speed shows a loss in both but still reaches the 8B city median in quality and exceeds it in speed.

The school represented in the diagram at the bottom of Figure 18 shows an erratic course of development and indicates the lack of grade standards. The 4B and 5A grades show relatively average quality and speed, the 5B and 6A show an increase in quality with considerable loss in speed, the 6B shows an equal gain in quality and speed. The last two years gain in speed but fail to maintain or gain upon the level in quality reached by the 6B.

Figure 19 presents graphs for two other schools which show the different emphasis placed upon speed and upon quality in the different grades. The standards of the teachers in the different grades within the same school are most variable. It indicates that the question of balanced development or progress in both speed and quality has not had the consideration of the principal.

FIGURE XIX

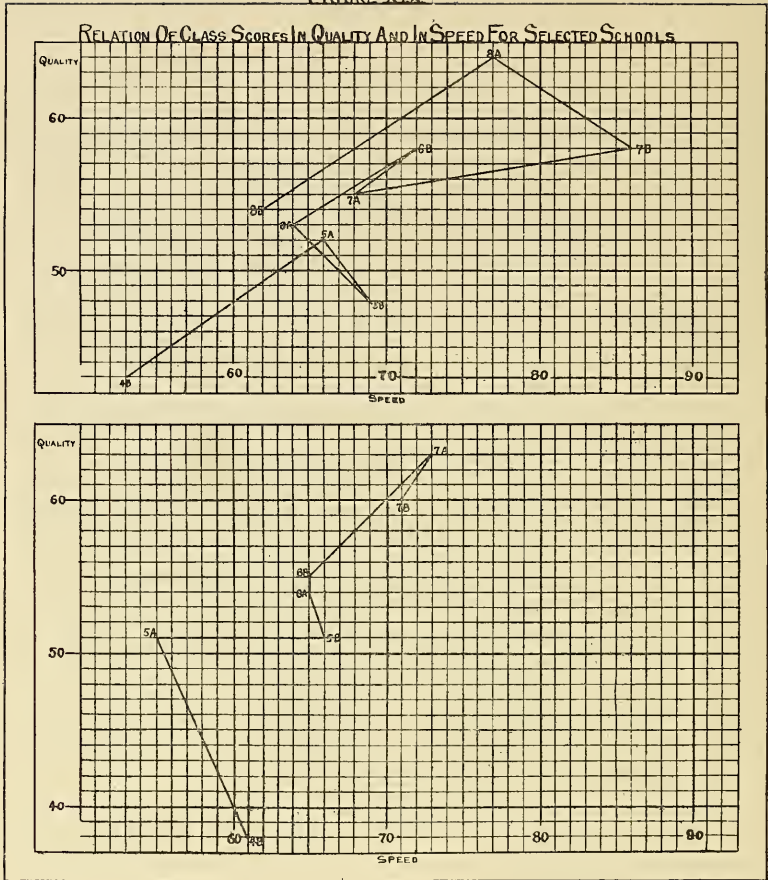
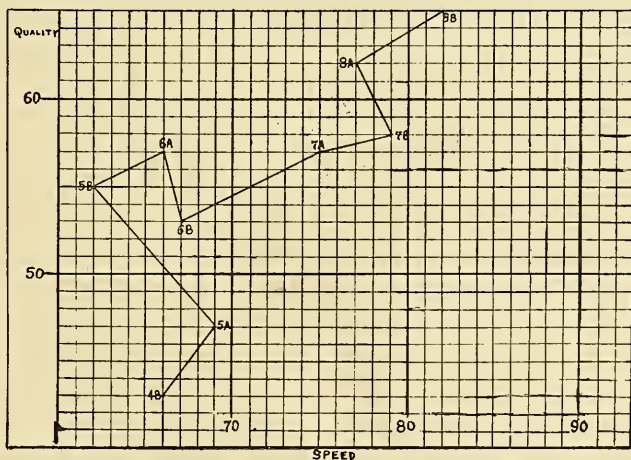
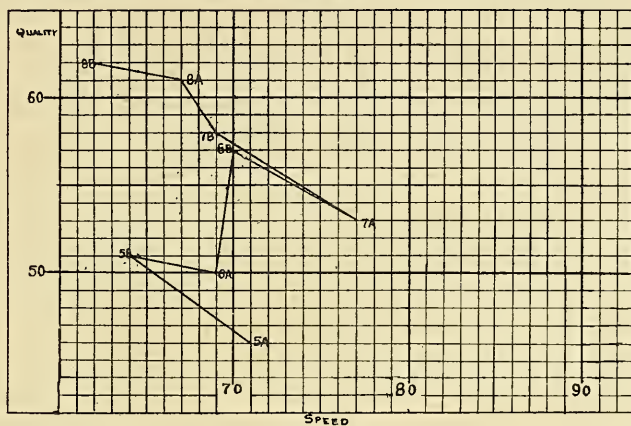
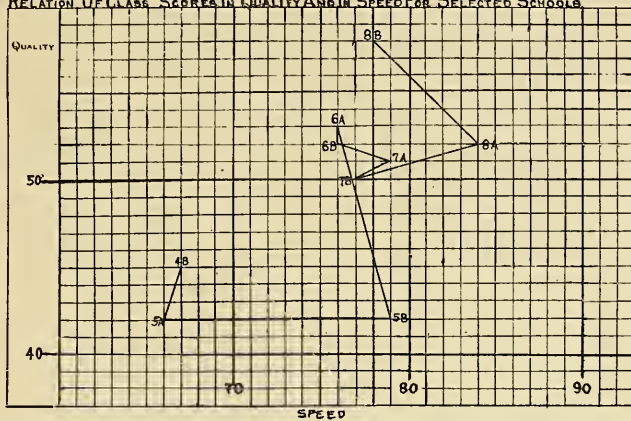


Figure 20 shows three additional illustrations of differences in relative emphasis upon quality and speed. The middle diagram shows a school in which the emphasis has been placed solely upon quality with no attempt to control or improve the rate of writing. Taking quality alone for instance we see improvement from the 5A to 5B from 46 to 51, a very slight loss in the 6A, a sharp rise in the 6B to 57, a loss in the 7A of four points, a gain in the 7B of five points to a score of 58, a further gain of three points in the 8A and of one in the 8B.

FIGURE XX

RELATION OF CLASS SCORES IN QUALITY AND IN SPEED FOR SELECTED SCHOOLS



All the grades with the exception of the 7A are equal to or above the city wide medians in quality. The speed shows a general trend toward the left. With the exception of the 7A no grade equals the 5A, the lowest grade (in this school) tested. The 5A with a speed of 71 exceeds the city wide 5A median of 66 by five letters. The 6A equals the grade median but all the other grades fall below their respective city medians. The school needs emphasis in speed, particularly in the upper grades.

The data presented above show the need and desirability of a study of grade standards in the several schools by the principals and teachers.

From the data presented it is quite apparent that the control of the schools over the product in penmanship is anything but effective. There is the greatest variability in achievement in the various classes of the same grade in different schools or between classes in the same grade within the same school. The median improvement from grade to grade is very slight and indicates how futile much of the instruction must be. The total improvement between the 4B and 8B grades is about two steps on the scale and this is equaled in most of the grades by the range of the middle 50 percent. of the pupils. The progress from grade to grade in most of the schools is uncertain and erratic. The situation is such that you can predicate practically nothing about the penmanship of an 8B pupil or even of an 8B class. It might do as well as the 6B city average or it might not. The 8B pupil might write as well as the 6B grade average with the speed of the 4B or even *vice versa*.

The situation is just what might be expected from a lack of standards to guide the teacher in her instruction or the principal in his supervision. Without the control which standard measurement yields the development of skill in penmanship is bound to be erratic.



### III. TENTATIVE GRADE STANDARDS

#### 1. THE DEGREE OF PENMANSHIP ABILITY FOUND IN THE BUSINESS WORLD

The end product of our school training is represented by the 8B pupil who is about to graduate. How well should a pupil in the 8B write? At what speed? Immediately we answer such questions by asking other questions. How well need he write? How fast need he write? We find our answers in the demands of society upon the pupil and in the needs of his later life.

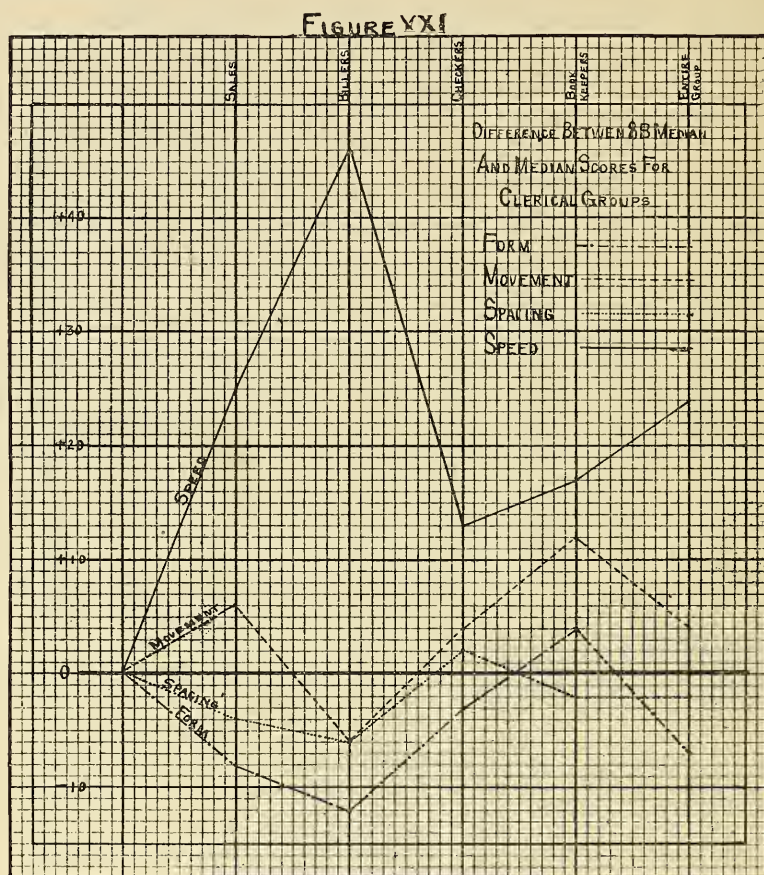
There have been a number of studies and investigations conducted to determine the degree of writing skill required by the outside world in various lines of endeavor. Such studies however were reported in terms of the Ayres scale so that the results could not be used in setting up norms for the New York scale. An independent attempt was made to determine the degree of skill in the various elements of handwriting, as measured by the New York scale, that was to be found in clerical workers. The Bureau obtained under test conditions samples of handwriting of clerical employees in several of our large department stores. The group tested numbered 161, distributed as follows: 98 salesclerks, 17 billers, 39 checkers, and 7 clerks and bookkeepers. In all these positions legible rapid writing was considered essential.

Table XII presents the median scores in each element for each of the above groups in comparison with the median scores of our 8B pupils.

TABLE XII—MEDIAN SCORES OF GROUPS OF CLERICAL EMPLOYEES IN DEPARTMENT STORES

Group	Number	FORM		MOVEMENT		SPACING		SPEED	
		Med.	Dif. from 8B	Med.	Dif. from 8B	Med.	Dif. from 8B	Med.	Dif. from 8B
8B Pupils.....	988	61	....	62	....	65	....	82	....
Sales.....	98	53	—8	68	+6	61	—4	107	+25
Billers.....	17	49	—12	56	—6	59	—6	128	+46
Checkers.....	39	58	—3	66	+4	67	+2	95	+13
Bookkeepers.....	7	65	+4	74	+12	63	—2	99	+17
Entire outside group.....	161	54	—7	66	+4	63	—2	106	+24

The data in Table XII are presented in figure 21 in terms of the amounts by which each employee group exceeded or fell below the 8B medians.



In form the salespeople fell 8 points below the 8B median, the billers 12 points, the checkers 3 points. The bookkeepers alone exceeded the 8B median, to the extent of 4 points. In movement, three of the four groups exceeded the 8B median, the billers falling below. In spacing, the outside group on the whole fell slightly below, the checkers this time being the only group to exceed the school median.

In speed the employee group greatly exceeded the rate of the 8B pupils, the salespeople writing at the rate of 107 letters per minute or 25 letters above the 8B median, the billers 128 letters or 36 above, the checkers 95 or 13 above and the bookkeepers 99 or 17 letters above the 8B rate.

The data presented above while suggestive are not conclusive. It is planned to continue the investigation so as to secure more accurate and complete data as to the demands for writing skill that are presented by the needs of the outside world.

## 2. TENTATIVE STANDARDS FOR EACH GRADE

The following table presents the tentative grade standards proposed for each element. They are shown in figures 22 and 23 in comparison with the upper quartiles and city wide medians.

TABLE XIII—TENTATIVE STANDARDS IN PENMANSHIP FOR THE NEW YORK PENMANSHIP SCALE

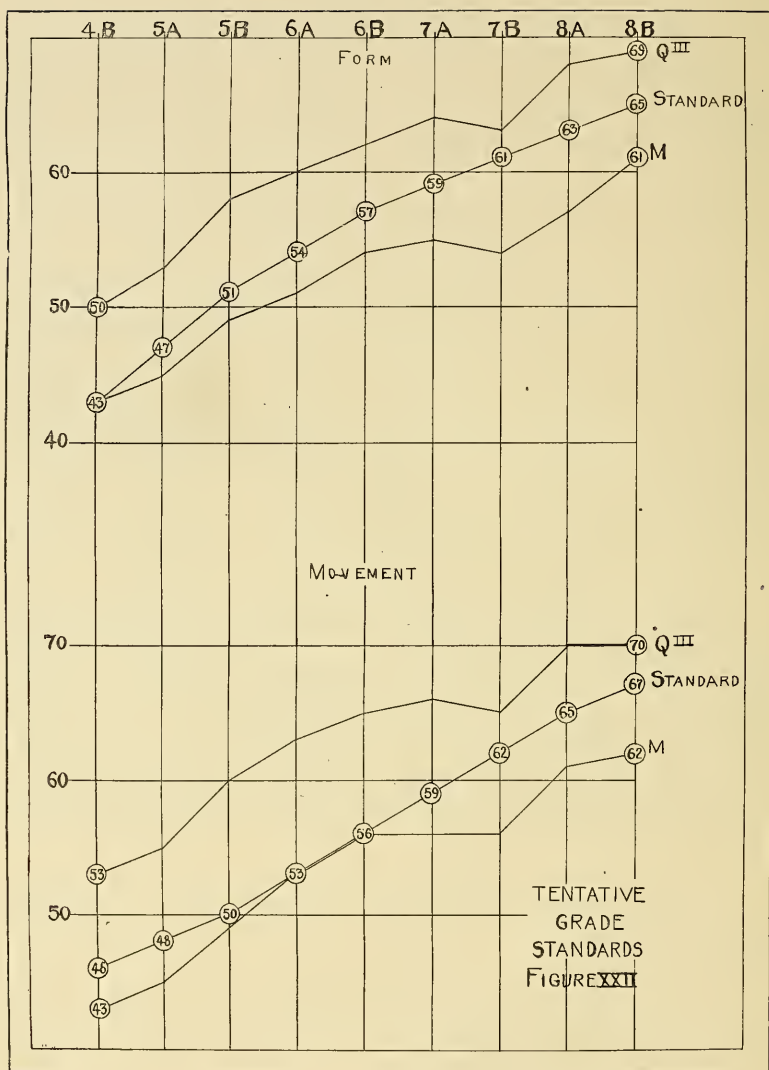
Grade	Form	Movement	Spacing	Speed
4B.....	43	46	48	56
5A.....	47	48	51	59
5B.....	51	50	54	63
6A.....	54	53	57	67
6B.....	57	56	60	71
7A.....	59	59	63	75
7B.....	61	62	65	80
8A.....	63	65	67	85
8B.....	65	67	69	90

For the 8B standard in form the average of the scores attained by the classes which exceeded the city wide grade median was taken. This score of 65 is already reached by 35 percent. of the 8B group tested or by 10 of the 33 classes involved. The lower end of the curve was begun at 43, the city wide median for the 4B. The curve of the grade standards was raised from the median curve, in some places arbitrarily, and in other places through smoothing to the points indicated. In the 6B, 7A, and 7B, the grade medians were on a level whereas the "standard" curve maintains an even progress.

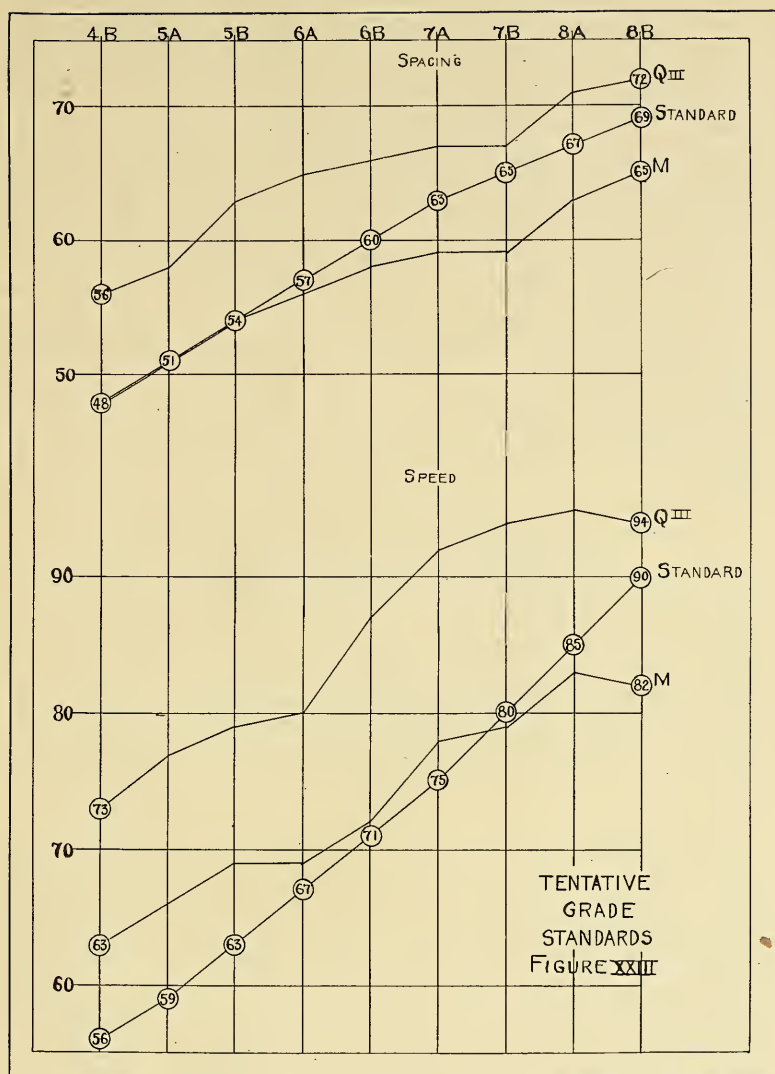
The same procedure was followed in the elements of movement and spacing, for which the proposed standards are presented in Figures 22 and 23.

For speed the standards adopted are taken from those set up by Freeman. Figure 23 shows that in the lower grades such speed norms are below the grade medians.

The above standards are frankly tentative. When the achievements of the better schools are considered, they are not regarded as unreasonable nor difficult of accomplishment. The schools are working under a uniform time allotment and what is accomplished in some of the schools ought to be attainable elsewhere.







### 3. THE VALUE OF GRADE STANDARDS

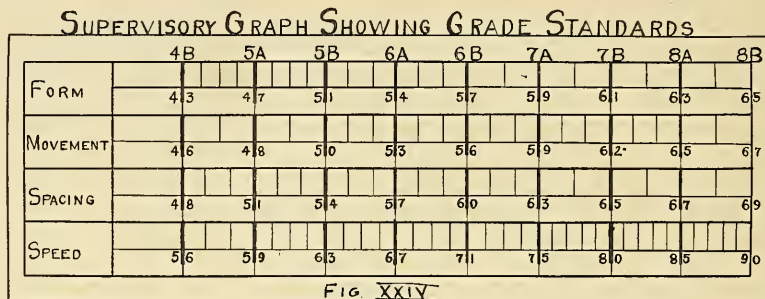
The movement for standard educational measurements has for one of its chief purposes the setting up of definite aims in the various subjects of the curriculum. For instance, the penmanship in our elementary schools aims to give the pupil a certain degree of writing skill. The course of study prescribes that seventy-five minutes a week be devoted to penmanship in the 1A to 6B grades and in that time the child be trained to write with legibility, ease and speed. Such aims are vague and indefinite and therefore afford no material guidance to the teacher and the principal in their work in penmanship.

Contrast the aim to teach an 8B pupil "to write with speed" with the aim "to write at the rate of 90 letters a minute." Contrast the aim "to write with legibility" with the aim "to write with a letter formation or quality equal to step 70 on the New York Scale." The use of standards provides definite teaching aims.

With definite aims set up the efforts of the teacher can be directed toward the specific goal instead of being spread over an indefinite field. With accurate means of measurement now available the teacher can readily find out how near she is coming toward achieving her goal and upon what to lay stress in order to attain her aim. In short it permits the teacher to plan her work more effectively.

They afford a basis with which to compare the present accomplishments of the pupils and thus to determine which pupils are below standard or above standard.

They provide definite goals for the pupils also. In this the use of standards will prove an effective means of motivating the instruction.



They provide a basis for making more effective the supervisory efforts of the principal and the superintendent. Figure 24 shows a graph which may be used for such purpose. The graph shows the standards in form, movement, spacing and speed for each grade. The standards for the 4B, for instance, are 43 in form, 46 in movement, 48 in spacing and 56 in speed. A 4B class that was standard in achievement in all elements would be indicated on the graph by a vertical line coinciding with the vertical line under 4B.

Figure 25 shows the use of this graph in a comparison of the achievements of 8B pupils in twelve schools. From this diagram it is possible to discover the elements in which a class is below standard and also the extent to which it is below standard. The graph shows that these classes are nearer the 8B standard in speed than they are in the other elements. It shows the wide variability in the performance of different schools. While some are above standard in form most of the twelve schools are below, several in fact showing but sixth year achievement. The superintendent is able to diagnose the situation in his district with respect to penmanship and to determine where his attention should be directed.

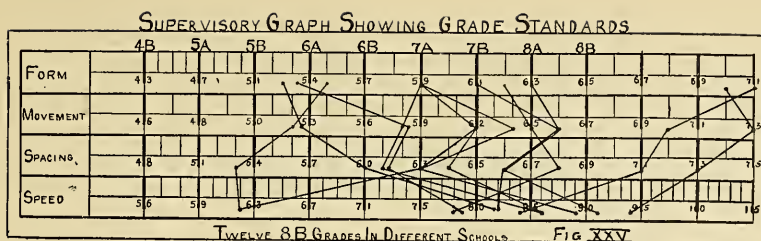
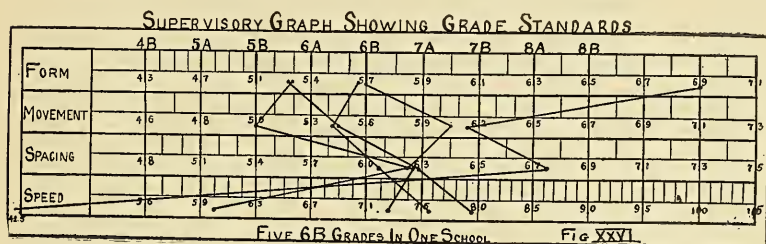


Figure 26 shows the achievements of five, 6B classes in the same school. Ordinarily it would be reasonable for us to expect that the scores of such classes would show agreement more or less close. The variability is apparent. In form two classes are below standard, two standard and one above. In movement one is below, two are quite close to standard and two are above. In spacing all are above. In speed there are three above and two below. The existing situation is made clear to the principal of this school who may now direct his attention more effectively where it is most needed.



In conclusion attention is called to one of the principles underlying all educational measurements, and that is the principle of the limitation of training. This principle means that as soon as a child has surpassed the standard of his grade he should be excused from any further direct training and should be given more profitable work. Particularly should this apply if the pupil has attained the skill set up as the ultimate goal of the elementary school. If the needs of the outside world have been a factor in determining such standards, as they should be, any further development of skill beyond such standards will not probably be a factor in determining the social efficiency of the individual. The development of higher levels of ability in preparation for a specific vocation is not the function of the elementary schools. Again, individuals with greater natural capacities will reach the standard level with much less training than individuals less favored by natural inheritance, and consequently for such individuals drill soon comes to have little meaning and in fact may be harmful. For the exceptionally able child the incidental training which comes through the use of his mechanical skill in real work, once the standard has been reached, will automatically develop his ability to higher levels without direct drill. The ordinary child, on the other hand, may probably require continuous direct drill to maintain his level.

# APPENDICES

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## APPENDIX A

### METHODS OF SCORING EMPLOYED IN THIS SURVEY

The scoring of the resulting twelve thousand samples of penmanship in each of the elements of form, movement, spacing and speed, represented an enormous task. The task was undertaken by Dr. Hamilton and Miss Scheuerman of the New York Training School for Teachers and by Mr. Lister of the Brooklyn Training School for Teachers. The services of training school students were enlisted.

While it is generally conceded that the use of a penmanship scale in the hands of trained scorers reduces considerably the variability in judgment which obtains when specimens are scored without such aid, it is also true that in the hands of untrained persons the penmanship scale gives no guarantee that the resulting judgments will be reliable. Nor does a knowledge of the theories underlying educational measurements or the statistical derivation of scales insure accurate scoring. Likewise expertness in teaching penmanship, while of some help, is not synonymous with reliability in scoring. To obtain accuracy in scoring there must be training in the use of the scale.

Investigations by Kelly and others have shown that teachers using the percent. method of rating have reduced their variability by practice at the expense of the children, while they have at the same time decreased their capacity for effective use of a standard scale.

It was considered advisable for the above and for other reasons to employ as scorers training school students rather than the teachers. The training school students who acted as judges had the following qualifications.—(1) They had been instructed in the muscular movement method of writing. (2) They had taken the normal course in teaching that method. (3) They had also had the course in educational measurements in the training school as a result of which they were familiar with the various penmanship scales and in the course of which they had received some practice in giving standard tests and in judging specimens of penmanship by means of standard scales.

To supplement the above favorable conditions, it was arranged to give the students, who were to act as scorers, specific instruction and training for a period of three weeks or longer in the use of the New York Scale through actual practice in judging specimens.



For use in the training of the judges standard specimens of writing were prepared, that is, the specimens were scored by one of the authors of the scale and four of his associates and a score assigned for each of the elements of form, movement and spacing. The specimens were coded so that the students were unaware of the "expert" score.

In scoring these practice samples, and subsequently the test papers, the ascending-descending method was used.

It was planned to give the student judges an initial test in scoring and at the end of the practice period a final test. The data resulting from these tests would afford a measure of the reliability of each prospective judge and a basis for eliminating some of the students from participation in scoring the test papers. Unfortunately school conditions and other circumstances prevented us from carrying out our programme in its entirety. We were, however, able to get an initial test for all the student judges and a final test for part of the group.

Table XIV shows for the initial test the average deviation per specimen from "expert" scores for the group of prospective judges. In this preliminary test there were twenty-one samples used.

TABLE XIV—AVERAGE DEVIATION PER SPECIMEN FROM "EXPERT" SCORES FOR 86 PROSPECTIVE JUDGES—PRACTICE SAMPLES

Element	DEVIATION IN POINTS																Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
Form....	3	3	8	24	20	15	11	2	1	....	....	....	....	1	....	1	5.07
Movement..	2	....	2	4	18	22	19	12	5	3	....	....	....	1	....	1	6.5
Spacing....	....	1	8	22	36	12	8	1	....	1	....	....	....	....	....	....	5.05
Total.....	5	4	18	50	74	49	38	15	6	4	....	....	....	2	....	2	5.5

It developed upon later analysis of these results that for those of the trial specimens which were taken from the scale there was a possibility of identifying the specimens through the content, which factor may have influenced the variability of the judging. Accordingly, those trial specimens which had been taken from the scale were excluded and the judgments retabulated on the basis of the remaining specimens with the following results:

TABLE XV—AVERAGE DEVIATIONS PER SPECIMEN FOR "EXPERT" SCORES  
FOR 86 PROSPECTIVE JUDGES—PRACTICE SAMPLES—SECOND TABULATION

Element	AVERAGE DEVIATIONS																	Average
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
Form.....	1	.....	.....	4	8	16	12	25	14	2	1	1	.....	.....	1	.....	1	7.9
Movement.....	.....	.....	.....	.....	3	8	3	14	15	15	17	3	3	1	1	1	2	10.1
Spacing.....	.....	.....	1	2	11	24	20	18	1	5	2	2	.....	.....	.....	.....	.....	7.4
Total.....	1	.....	1	6	22	48	35	57	30	22	20	6	3	1	2	1	3	8.3

The above table shows the average deviation of each of the 86 prospective judges in scoring the practice samples. Under form, for instance, one judge deviated on the average from 1 to 2 points from the "standard" scores given the practice samples, 4 deviated on the average 4 points, 8 deviated 5 points, and so on. The average of these average deviations was 7.9 for form, 10.1 for movement and 7.4 for spacing. The greatest deviation appeared in the element of movement.

TABLE XVI—DEVIATIONS PER JUDGMENT

Element	—40	35	30	25	20	15	10	5	0	+5	10	15	20	25	30	35	40	Total	Aver.	
Form.....	.....	2	11	12	26	46	134	134	300	154	156	78	35	12	12	1	1	1,114	7.9	
Movement.....	.....	5	22	20	38	89	51	211	168	171	206	28	85	5	20	2	4	1,125	10.1	
Spacing.....	.....	1	1	2	4	16	76	97	226	216	317	118	86	17	16	3	2	1,199	7.2	
Total .....	.....	6	25	33	54	131	173	442	528	687	677	302	249	57	48	17	7	2	3,438	8.4

Table XVI shows the distribution of the judgments given by the 86 prospective judges in scoring the practice samples, in terms of their deviations plus and minus from the standard or expert scores. The table is read as follows:

Out of 1,114 judgments in form given by the 86 judges 2 were 35 points below the "expert" score, 11 fell 30 points below, 12, 25 points below, and so on. Three hundred judgments agreed with the "expert" score, 154 exceeded it by 5 points, 156 by 10 points and so on. Likewise for the other elements.

Table XVII shows for each element the number and percent. of judgments that deviated by various scale amounts.

TABLE XVII—DEVIATION ACCORDING TO AMOUNT

Deviations	FORM		MOVEMENT		SPACING		TOTAL	
	No.	Percent.	No.	Percent.	No.	Percent.	No.	Percent.
Zero deviations.....	300	26.9	171	15.2	216	18.0	687	20.0
5 points or $\frac{1}{2}$ step	288	25.9	374	33.2	543	45.3	1,205	35.1
10 points or 1 step..	290	26.0	239	21.2	215	18.0	744	21.6
15 points or $1\frac{1}{2}$ step	124	11.1	136	12.1	162	13.5	422	12.3
20 or 2 steps or more	112	10.0	205	18.2	63	5.2	380	11.0
Total.....	1,114	99.9	1,125	99.9	1,199	100.0	3,438	100.0

Under form it will be seen that 878 or 78.8 percent. of the judgments fell within one step of the scale from the "standard or expert" score. In movement 69.6 percent. of the judgments deviated one step or less, while in spacing the number of such judgments was 81.3 percent.

It is to be borne in mind that the above data are for the initial test given at the beginning of the period during which it was planned to give rather intensive training to those students who were to serve as scorers. While school conditions and extraneous circumstances prevented us from carrying out our programme in its entirety, it is believed that the variability of those who finally acted as judges was considerably reduced from the degree indicated in the above table.

For a number of the judges to whom a second formal test was given it was possible to secure data which indicated the improvement attained. Table XVIII shows for 56 of our prospective judges the average deviations in the initial test in comparison with the results of the final test.

From this table it is seen that the average deviation for the 56 judges on the initial test was 7.5 points on the scale or  $\frac{3}{4}$  of a step. On the second test, several weeks later, the average deviation of the group was 4.2 points or less than  $\frac{1}{2}$  of a scale step. The figures to the left of the heavy zigzag line indicate the students who showed improvement in scoring. Those to the right of the line represent the students whose scoring showed the same amount of deviation or an increase therein. For instance, there were 17 students whose average deviation on the first test was 8 points. On the second test these 17 students were distributed as follows: 1 deviated less than one point; 1 deviated one point; 5 deviated two points; 2, six points; and 1, seven points. All these showed considerable improvement. On the other hand, 4 deviated nine points or one point more on the second test than on the first test; 1, ten points and 1, eleven points. These six showed a loss in accuracy. Of the

56 students, 42 showed improvement, in some cases marked, 3 showed no progress, while 11 showed a slight loss, that is an increase in variability.

TABLE XVIII—AVERAGE DEVIATIONS FOR 56 PROSPECTIVE JUDGES IN TWO TESTS

Average Deviations	AVERAGE DEVIATIONS—2d TEST																		Total	
	0-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	1st Test
18.....																			1	1
17.....									1											1
16.....																				...
15.....																				...
14.....																				...
13.....																				...
12.....					1															1
11.....								1												1
10.....					1															1
9.....	2			1		2	2					1								8
8.....	1	1	5			1	2	1		4	1	1								17
7.....	1			1	1				2	1										6
6.....	2		3	3		1	1		1											11
5.....	2	1	1	1	1															6
4.....			1	1																2
3.....																				...
2.....																				...
1.....		1																		1
Totals																				
2nd Test....	8	3	10	7	4	4	5	2	4	5	2	1							1	56
	Average 4.5																		Aver. 7.5	

## APPENDIX B

### RELIABILITY OF THE SCORING

The papers of about 15 percent. of the classes involved in the test were scored by groups of three judges, each scorer working independently. The data from twenty such classes were analyzed and afford a fair measure of the reliability of the scoring in general.

Table XIX shows as an illustration the scores in form assigned by three judges to each paper in a 5A class. The table is to be read as follows:—Judge I rated the paper of pupil number 1, at 30 on the scale in form, Judge II rated it as worth 25, and Judge III assigned the mark of 30. The median of the three judgments was 30. The scores of Judge I and III showed zero deviation, while that of Judge II was 5 points below. The total deviation of the group from the median score was 5 points, or an average of 1.7 points. Out of the total of forty specimens in the class, the three judges agreed absolutely as to the value of 13, or about one-third of the papers. On most of the other samples also the judges showed very close agreement. In only a few cases is there any wide variation, for instance, papers No. 7 and 18.

At the bottom of the columns headed "Deviations" appears the sum of the deviations of the scores of each judge. Judge I shows a total of 70 on the 40 papers, or an average deviation of 1.8 points; Judge II has a total of 130 or an average deviation of 3.3 points, while Judge III deviated on the average only four tenths of a point. The total deviation on the entire set of papers for the three scorers was 215 or an average of 1.8 points, less than a fifth of a step on the scale.

At the foot of the columns headed "scores" appears the medians based upon the scores given by each judge. The median of the scores given by Judge I is computed at 39.5, that of Judge II at 40.7, and that of Judge III at 39.4. The median class score computed from the median score on each sample is 40. The class medians given by the three judges are practically identical, Judge I differing but by five tenths of a point, Judge II by only seven tenths and Judge III by six tenths of a point. The average deviation of class medians for the three judges from the class median computed from the median score on each sample is but six tenths of a point.

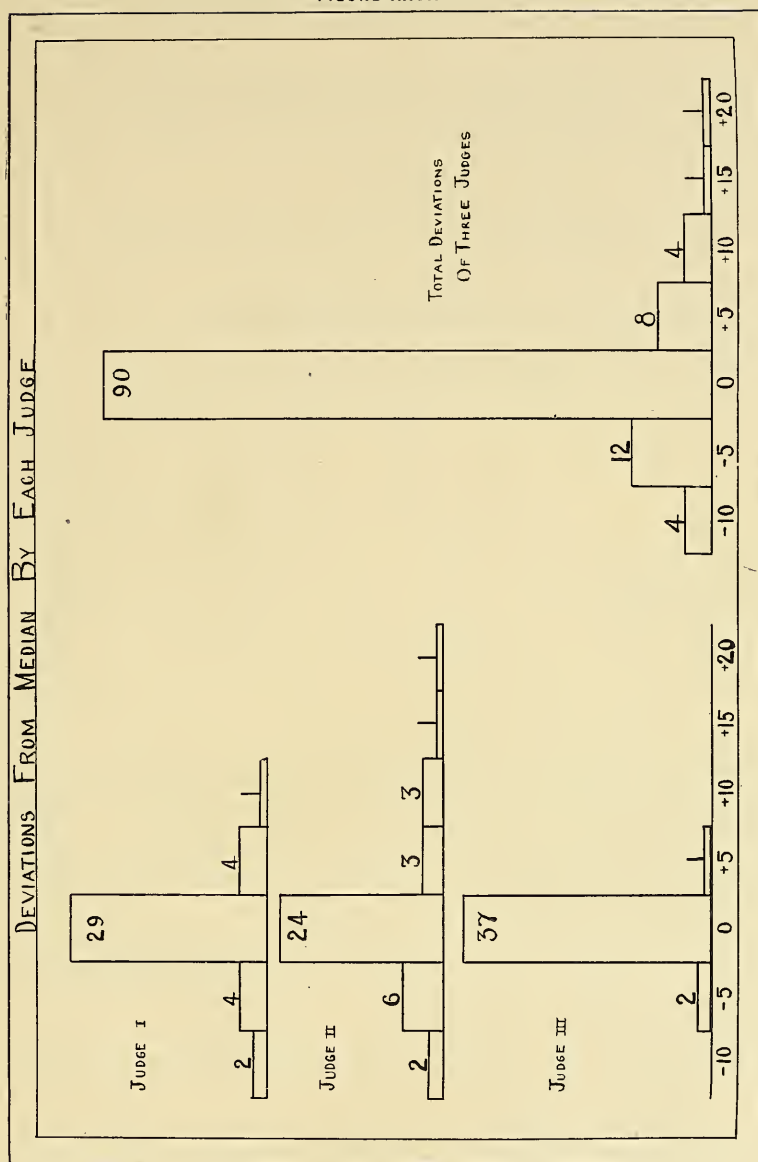


TABLE XIX—SCORES IN FORM OF A FIFTH GRADE CLASS GIVEN BY  
THREE JUDGES SCORING INDEPENDENTLY

Pupil's Sample	SCORE ACCORDING TO JUDGE			Median Score	DEVIATION OF EACH JUDGE			Total	Average Dev.
	I	II	III		I	II	III		
1.....	30	25	30	30	0	-5	0	5	1.7
2.....	30	35	35	35	-5	0	0	5	1.7
3.....	35	40	35	35	0	+5	0	5	1.7
4.....	40	40	40	40	0	0	0	0	0.0
5.....	40	40	40	40	0	0	0	0	0.0
6.....	40	45	35	40	0	+5	-5	10	3.3
7.....	45	70	50	50	-5	+20	0	25	8.3
8.....	35	35	35	35	0	0	0	0	0.0
9.....	35	25	25	25	+10	0	0	10	3.3
10.....	25	25	25	25	0	0	0	0	0.0
11.....	35	25	35	35	0	-10	0	10	3.3
12.....	50	60	60	60	-10	0	0	10	3.3
13.....	40	35	40	40	0	-5	0	5	1.7
14.....	40	35	40	40	0	-5	0	5	1.7
15.....	30	25	25	25	+5	0	0	5	1.7
16.....	35	25	35	35	0	-10	0	10	3.3
17.....	30	25	25	25	+5	0	0	5	1.7
18.....	30	45	30	30	0	+15	0	15	5.0
19.....	40	35	35	35	+5	0	0	5	1.7
20.....	40	50	40	40	0	+10	0	10	3.3
21.....	30	40	30	30	0	+10	0	10	3.3
22.....	40	50	40	40	0	+10	0	10	3.3
23.....	35	25	30	30	+5	-5	0	10	3.3
24.....	35	40	40	40	-5	0	0	5	1.7
25.....	30	25	30	30	0	-5	0	5	1.7
26.....	40	45	45	45	-5	0	0	5	1.7
27.....	30	30	30	30	0	0	0	0	0.0
28.....	40	40	40	40	0	0	0	0	0.0
29.....	45	45	45	45	0	0	0	0	0.0
30.....	45	40	45	45	0	-5	0	5	1.7
31.....	40	40	40	40	0	0	0	0	0.0
32.....	30	40	40	40	-10	0	0	10	3.3
33.....	40	40	40	40	0	0	0	0	0.0
34.....	40	40	45	40	0	0	+5	5	1.7
35.....	25	25	25	25	0	0	0	0	0.0
36.....	40	40	40	40	0	0	0	0	0.0
37.....	35	35	35	35	0	0	0	0	0.0
38.....	35	35	30	35	0	0	-5	5	1.7
39.....	40	40	40	40	0	0	0	0	0.0
40.....	35	40	35	35	0	+5	0	5	1.7
Class median.....	39.5	40.7	39.4	40	....	....	....	....	....
Totals.....	....	....	....	....	70	130	15	215	....
Average...	....	....	....	....	1.8	3.3	0.38	1.8	....

This is remarkably close scoring. It is probably the best performance revealed by the analysis of the data. The following tables will show that while not as excellent a showing was made by the other scorers, the scoring was on the whole very consistent and quite satisfactory.

FIGURE XXVII



The twenty classes for which the data were worked up in detail totaled 753 specimens. Each of these specimens received three scorings or judgments, making a total of 2,259 judgments. The fol-

lowing table and figures show the distribution of these judgments in terms of deviations from the median score for each paper.

TABLE XX—DISTRIBUTION OF INDIVIDUAL SCORES IN TERMS OF DEVIATIONS FROM MEDIAN SCORES ON EACH SAMPLE

Element	DEVIATIONS													Total	Average
	-30	-25	-20	-15	-10	-5	0	+5	+10	+15	+20	+25	+30		
Form.....	1	2	11	37	128	297	1,310	278	131	49	10	2	3	2,259	3.27
Movement....	1	5	12	55	137	281	1,249	300	152	42	18	6	1	2,259	3.62
Spacing.....	2	4	16	64	143	249	1,279	288	140	56	12	6	....	2,259	3.62
Total.....	4	11	39	156	408	827	3,838	866	423	147	40	14	4	6,777	3.5

Amount of Deviation	FORM		MOVEMENT		SPACING	
	Number	Percent.	Number	Percent.	Number	Percent.
0.....	1,310	58.0	1,249	55.3	1,279	56.6
5 points or $\frac{1}{2}$ scale step.....	575	25.4	581	25.7	537	23.8
10 points or 1 step.....	259	11.5	289	12.8	283	12.5
More than 10 points or 1 step....	115	5.1	140	6.2	160	7.1
Total.....	2,259	100.0	2,259	100.0	2,259	100.0

Out of the total of 2,259 judgments in form, 1,310 or 58.0 percent. agreed with the median score; 473 or 20.9 percent. were positive deviations and 476 or 21.0 percent. were negative. The lower part of the table shows that 25.4 percent. of the judgments deviated 5 points or one half step on the scale; 11.5 percent. deviated one step and 5.1 percent. more than one step.

In movement 55.3 percent. of the judgments agreed with the median scores, 519 or 23.0 percent. were positive deviations, while 491 or 21.7 percent. were negative.

Out of the total, 25.7 percent. of the judgments deviated one half step on the scale, 12.8 percent. deviated a full step and 6.2 percent. more than a full step.

In spacing, 1,279 out of the 2,259 judgments or 56.6 percent. agreed with the median scores, 502 or 22.2 percent. were positive deviations while 478 or 21.2 percent. were negative. Of the total judgments, 23.8 percent. deviated 5 points or half a scale step, 12.5 percent. deviated a full step and 7.1 percent. more than a scale step.

The average deviation per judgment is 3.3 points in form, 3.6 in movement and 3.6 in spacing. This means that on the average

a judgment by one judge on an individual sample will vary less than four tenths of a scale step from the median of three independent judgments.

Looking at the matter from the standpoint of the individual judge rather than the individual paper, we may consider the data presented in Table XXI. Table XXI shows for each of the sixty judges involved the average deviation per sample. These average deviations are based on the judgments given to the papers of a class compared with the median score of the group of three judges in each case.

TABLE XXI—AVERAGE DEVIATION PER SAMPLE FOR 60 JUDGES

Amount	Form	Movement	Spacing
0.0 to 1 point.....	2	1	2
1 to 2 points.....	8	7	9
2 to 3 points.....	17	13	17
3 to 4 points.....	16	19	10
4 to 5 points.....	11	11	9
5 to 6 points.....	2	4	6
6 to 7 points.....	3	2	1
7 to 8 points.....	....	1	3
8 to 9 points.....	1	1	1
9 to 10 points.....	....	1	2
Total.....	60	60	60
Average.....	3.3	3.6	3.7

For instance, two out of the sixty judges showed an average deviation on the papers of the classes scored by them of less than one point; eight judges differed less than two points; seventeen judges deviated on the average less than three points, and so on.

In form the average of the average deviations for the group of sixty judges was 3.3 points per judge, in movement it was 3.6 points, and in spacing 3.7 points.

While the scoring on the whole showed very satisfactory agreement, there was considerable variation shown by individual judges in the case of individual samples. The bulk of the papers were scored by a single judge. In order to get a true index of the value of any individual paper it would probably be necessary to have such paper scored by more than one judge or more than once by the same judge. With an increase in the number of judges we would obtain a consensus of opinion which would yield us the real value of the paper. Our study, however, was directed more to the performance or achievements of groups of pupils rather than of individuals.

In dealing with the class scores it is probably safe to say that such scores are more reliable than any score given to an individual



paper. On the whole, while the scores of an individual judge may vary more or less widely from the median of the three independent judgments, the median score for a class set of papers given by one judge shows less variation and closer agreement with the class median based on the group scores. It is possible and probable that the deviations of the individual scores for the one judge may counteract each other,

Figure 28 shows graphically the data presented in Table XX, the distribution of the 2,259 judgments in terms of their plus or minus deviations. In each of the elements the symmetrical character of the diagrams is to be noted. The number of the positive deviations equals or nearly equals the number of negative deviations. In the scoring of large groups of papers, the deviations in one direction would in all probability be corrected or counteracted by the deviations in the other directions so that the median as found would approximate very closely the actual median value of the group performance.

Fig. XXVIII. DEVIATIONS FROM MEDIANS-2259 JUDGEMENTS

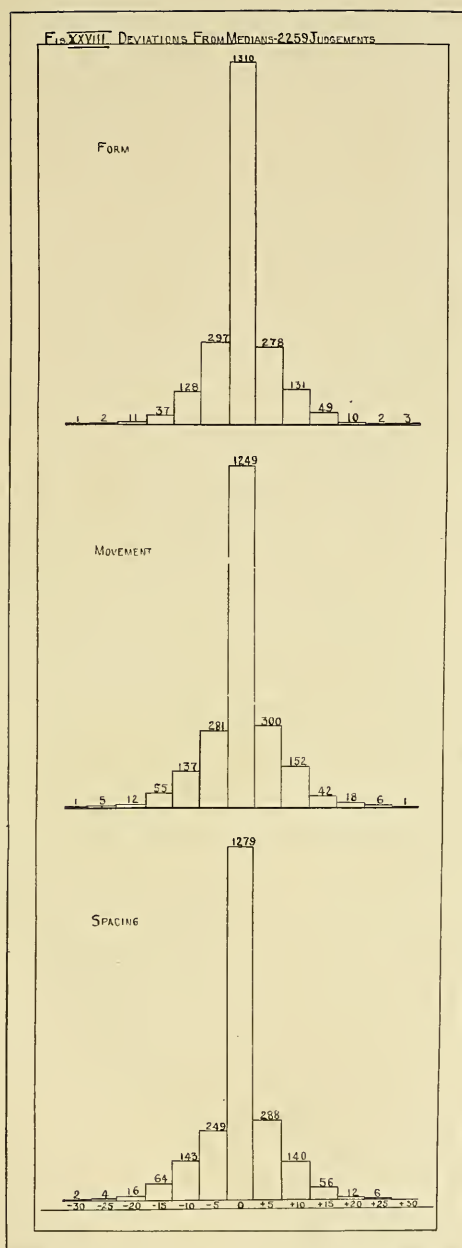


TABLE XXII—AVERAGE DEVIATION PER CLASS SCORE FOR TWENTY GROUPS OF SCORERS

Amount	Form	Movement	Spacing
0.0 to 1.0 point.....	5	4	4
1 to 2 points.....	7	5	3
2 to 3 points.....	3	5	5
3 to 4 points.....	4	2	3
4 to 5 points.....	...	3	2
5 to 6 points.....	1	1	3
Total.....	20	20	20
Average.....	2.0	2.4	2.8

Table XXII shows the average deviation of each group of three judges from the class median based on the group scores. In form out of the 20 groups, 5 groups deviated on the average less than 1 point, 7 less than 2 points, 3 less than three and 1 more than four points. The average of the average deviations was 2 points in form, 2.4 points in movement and 2.8 points in spacing. For the individual judges rather than for groups, the average of the average deviation in form was 2.2 points, in movement 2.6 points and in spacing 2.7 points.

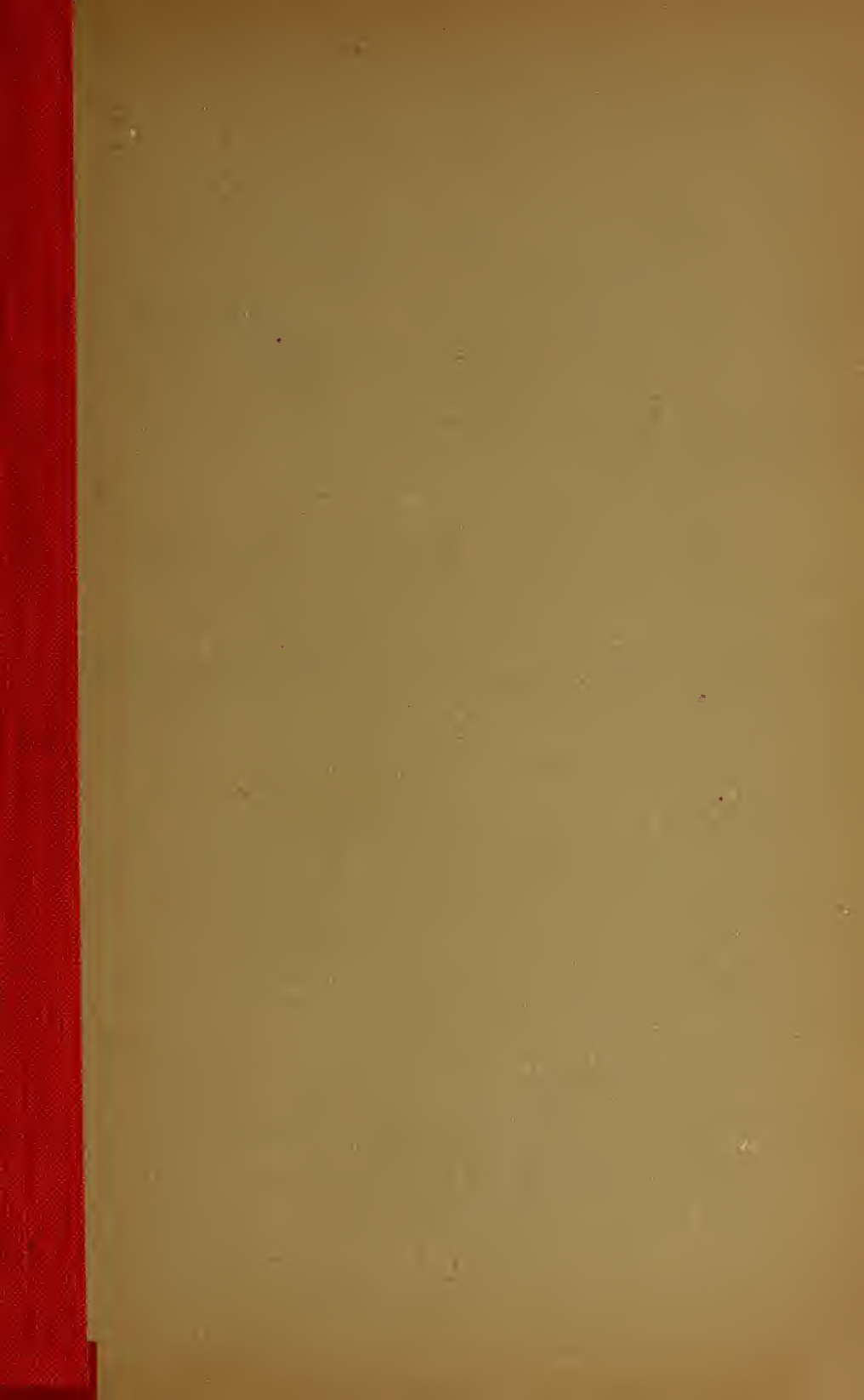
On the whole, then, the class medians resulting from the scoring of one judge may be taken as the actual value of the writing of the class and will be in error less than three points, or three tenths of a scale step.

Our main interest lies not even in the performance of class groups but in the achievement of larger grade groups. With the increase in numbers involved there is a strong probability that the grade medians given for the entire group, involving in each case about 1,000 pupils, represents the actual value of the performance of the group.









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